Volume 144, No. 6 May, 1957

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# WORLD OIL

Established 1916 as The OIL WEEKLY


# a quick look at WORLD OIL this month

**BUSY OIL MEN: To help you put first things first, scan these time-saving digests on this and the following pages, checking ☑ those you want to read first.**

## CURRENT OUTLOOK

☐ **If the Suez were closed** to the West, would that mean stoppage of Middle East oil shipments? Further dependence on the Canal seems to indicate that. A way must be found to alleviate this condition. On Page 89 is a partial solution to "beat" Suez.

☐ **"Jumboizing" of T-2 tankers** may become big business. Gulf Oil Corporation has announced successful sea trials of the *Gulfbeaver*, a war-built tankship to which a new 354-foot midbody was added to replace the original midships section of the hull. The tanker was out of service only 36 days. American Oil Company was scheduled to put its jumboized *Amoco Delaware* to sea by May 1 to confirm the practicability of a technique that may be of great importance to the world tanker fleet. See **Page 90. First Jumboized T-2 Tankers to Be in Operation Soon . . . . . H. T. Brundage**

☐ **Ten times former oil output** was achieved in a small Oklahoma field by a new technique in secondary recovery. It involves injection of liquid propane in the reservoir, after first injecting dry gas to keep the propane from evaporating underground. After the propane is injected, more gas is injected, forcing the propane and oil toward the wells. It is believed the technique can be used with even greater success in larger fields. **Injected Propane Boosts Oil Production, Page 92.**

☐ **The old problem of what to do** about oil imports again is demanding national attention. Its importance will be increased as Middle East oil gets back into the world markets in increased volumes following the Suez Canal crisis. U. S. government officials are studying various proposed oil import controls including quotas and tariffs. Government action may be

**Turn the Page ▸**

# Special OFFSHORE REPORT

**(Pages 117-149)**

TWELVE MONTHS AGO, the WORLD OIL staff chose offshore operations as a major reporting effort in 1957. The reasons were many.

Seldom, if ever, has any industrial project accomplished so much so fast with so little financial return—midst the hampering effects of so many government hassles.

This over-all picture gave rise to a multiplicity of pertinent questions. What *have* offshore operators accomplished? What *are* the new developments in offshore exploration, drilling and production? What *is* the economic situation? What *is* the background of government litigation and how has it affected offshore operations? What *does* the future hold?

For 12 months the WORLD OIL staff has been seeking the most authoritative answers to these questions, traveling more than 3000 miles to different installations—spending thousands of man hours researching every aspect of offshore operations. The aim was to provide WORLD OIL readers with the most complete, factual offshore report published to date.

That aim has been accomplished. In the 23-page special staff report starting on Page 117, you will find full coverage of past, present and future developments in offshore:

- **Economics**
- **Government Litigation**
- **Exploration**
- **Drilling**
- **Production**
- **Transportation**
- **Communications**
- **Personnel**

Reprints of the Special Report are available for 15 cents per copy.



delayed until next year when Congress must again consider extension of the Reciprocal Trade Agreements Act. Turn to **Page 94. Action on Imports Problem May Be Delayed Until 1958**.....**Joseph Huttlinger**

☐ **How To Prevent and Extinguish Floating Roof Tank Fires . . .** What causes floating roof tank fires? What type of floating roof tank is the least conducive to fire? What is the most effective way to fight these fires? Answers to these and many other questions regarding floating roof tank fires are given by one of the nation's top authorities on fire protection. See **Page 100. Controlling Floating Roof Tank Fires** (Part 4) **J. L. Risinger.**

## NEXT MONTH . . . *the big story*

### EXPLORATION ARTICLES

☐ **Geology shows the potentialities** in the Sinu Basin. Reactivated exploratory effort in the Floresanto anticline area may uncover commercial reserves of importance. Past drilling programs point to commercial production in the area which has remained untouched for an extended period. For further details see **Dr. Victor Oppenheim's Sinu Basin in Colombia May Produce New Reserves**.....**Page 151**

☐ **A veritable maze of oil traps** are to be found within a segment which connects the Ardmore and Anadarko Basins in Oklahoma. Velma, Sholem,

WORLD OIL, published every month except semi-monthly in February and August. Entered as THE OIL WEEKLY as second class mail matter December 23, 1916, at postoffice at Houston, Texas, under the act of March 3, 1879.

Alechem, etc., fields lie within a rather broad belt which has been steeply folded by the flanking Arbuckle and Wichita uplifts. See **Southern Oklahoma—a Complex Geologic Puzzle** by **Fred P. Schweers**....**Page 156**

☐ **Further field experimental** work proves the value of a new method for magnetic interpretation. See **Magnetic Interpretation by Domain Method May Aid in Search for Reefs** by **Mark Milstein** **Page 160**

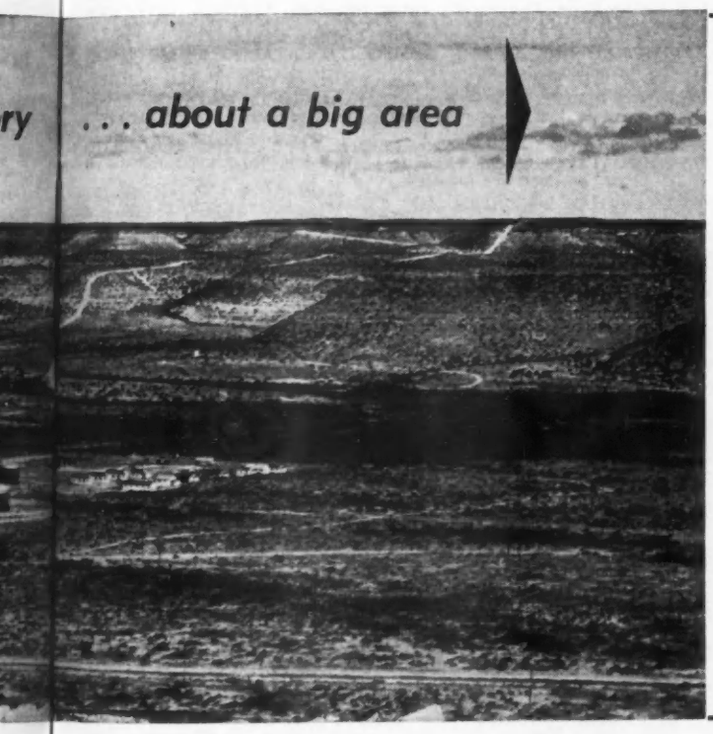
**DRILLING ARTICLES**

☐ **Scarce high alloy steels** aren't being resorted to, but manufacturers are providing operators with high strength casing for the deep wells and high formation pressures. To see what types of casing will be available in the future and the manufacturing processes involved, read **High Yield Strength Oil Well Casing** by **S. Prisuta** and **H. B. Emerick** on.....**Page 165**

☐ **The empirical method of inferring** production in log evaluations can be overcome by this new method which provides a positive breakdown of total water saturation into bound and movable water. This information is required for a well productivity forecast. The second part of this article on **Formation Evaluation by Log Interpretation is entitled: "Interpretation of Well Logs in Water-Wet Rocks of Intergranular Porosity"**; written by **Sylvan J. Pirson**, begins on...**Page 170**

☐ **Pulling stuck liners,** packers, and pipe used to impose a severe strain on the surface equipment, and in particular the derrick. Now when it is necessary to "get rough" and exert a great pulling force it is done hydraulically. For a description of the hydraulic fishing tools in use today and their method of operation read Part 4 of **Fishing Tools and Techniques** entitled **Hydraulic Pulling Tools** by **Weldon L. Medders** beginning on .....**Page 184**

☐ **Safety is as safety does.** Being aware of the dangers on a rig and group discussing them promotes accident prevention. See **Rig Safety Meetings Promote Team Spirit** by **John Jorgensen**.....**Page 196**




## West Texas—New Mexico

THE 60,000-SQUARE-MILE area stretching from the southeastern corner of New Mexico into West Texas, referred to as the Permian Basin and often called the "third oil state," produces more oil than any like-sized area in the U. S.

Rugged operating conditions on the wind-swept plains have made this the oil man's testing ground for new equipment and techniques. If it works in the Permian Basin, it will work anywhere, is the common saying.

The June issue of WORLD OIL will bring you a collection of articles dealing with the problems of this area. Problems ranging from drilling mud, drill pipe, and air and gas drilling to water-flooding and fracturing.

**Don't miss it in your June issue of World Oil!**

**PRODUCTION ARTICLES**

☐ **Offshore weather conditions** are a serious consideration for operators in the Gulf of Mexico and along its shore. Take a close look at the design problems brought about by hurricanes. See the effect a rough sea can have on daily activity. The problems and some suggested solutions are aptly presented by an authority on weather and the sea in **Weather—Waves—and Offshore Oil** by **Dr. John Freeman**.....**Page 201**

☐ **Handling an offshore gas well** during its initial unloading and cleaning can be the most critical and dangerous job in the life of the well. The procedures and precautions taken by The Pure Oil Com-

pany have served them well for a number of years. Their story may provide you with some ideas for handling medium and high pressure wells. The details are presented by **E. E. Reardon** on **Page 207.** See **Cleaning an Offshore Gas Well.**

☐ **A casing potential survey** in the San Miguelito field, California, was surprisingly successful in predicting casing condition. Photographs of the casing illustrate a problem that you may face. This entire project is analyzed and discussed by **J. D. Sudbury** in **External Casing Corrosion—Where Is It . . . How Bad Is It?** ..... **Page 210**

☐ **Handling offshore production** will become an increasingly difficult problem in light of the predicted spurt in development drilling this year. Increased use of the central production platform as an economical solution to the problem seems assured. The economics and engineering of these offshore giants is capably discussed by **A. H. Massad** and **E. C. Pela** in **A Production Platform Pays Off** ..... **Page 223**

## INTERNATIONAL ARTICLES

☐ **An important 30-mile pipe line** project which will connect Duri and Bekasap oil fields in Central Sumatra to a deep-water terminal to be built on the Malacca Strait has been begun by Caltex Pacific Oil Company. Eventually, a large diameter pipe line is expected to be built to connect the major producing field of Minas with the Duri-Bekasap system. See **Page 235** for **New Caltex Pipe Line to Link Fields, Port** by **H. T. Brundage.**

☐ **Herodotus' contemporaries** (400 B. C.) recorded in literature an oil field which today has a proven production at 250 feet and crude oil heavier than water. Israel Mediterranean Petroleum, Inc., and Pan Israel Oil Company, Inc., are viewing it as operators of the concessions covering the Island of Zante in western Greece. The small island has an excellent oil potential. See **U. S. Firms Seek to Restore Greek Island's Production** ..... **Page 238**

☐ **Six million acres are** covered in the 49 concessions granted by the Philippines government. Drilling plans have been scheduled by various private companies. For details about this area of growing interest, see **Page 239** for **Philippines Oil Search Is Spreading.**

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*Indexed by Industrial Arts Index and Engineering Index*

# Looking Ahead . . .

***Drop in Oil Demand Is Seasonal . . .*** Gradual improvement in the currently lagging demand for petroleum is to be expected in coming months. May usually brings about the lowest oil consumption of the year. Heating oil sales are off sharply, and gasoline use is yet due to rise to higher levels of summer. In June and July, total oil use should be on the rise. While domestic consumption now is off seasonally, emergency exports to Europe also are diminishing, with reopening of the Suez Canal.

***Low Allowables Fit Smaller Demand . . .*** Texas crude production allowables have been cut to fit the new, lower demand for petroleum. The state's May 1 allowable of 3,474,834 barrels daily was a cut of 82,156 barrels under mid-April. The April 1 quota had represented a sharp cut of 224,710 barrels daily from the record high of March 15.

Louisiana conservation officials expected to cut that state's allowable about 40,000 barrels for May, to around 880,000 barrels daily. It was 920,000 daily in late April, and had reached a peak of 990,642 barrels in March, compared with 773,982 daily in March of last year.

***Action on Gas Bill Possible . . .*** Early hearings are planned for the natural gas bill introduced in the House of Representatives by Chairman Harris (D-Ark.) of the Commerce Committee. The bill would exempt independent producers from federal fixing of gas prices at the well. Supporters of the bill have been encouraged by the recent cautious endorsement of such legislation by President Eisenhower at a press conference.

***Inflationary Pressures Abating . . .*** Inflationary pressures in the nation's economy are abating, according to government economists. Although consumer price index reached new highs during the past six months, officials interpret this situation as a carryover from last year's steep rise in wages, materials and equipment costs. Actual output of goods and services will tend to halt inflationary spirals, and business will benefit therefrom during the balance of 1957.

***'Tight Money' Pinches Oil Operators . . .*** Money for oil loans which has been "tight" for several months, shows no signs of easing up. Banks specializing in this type of financing report they are taking care of old customers and have had to turn down much new business. Loan officials generally report the situation as follows: There is money available for oil loans, but only for established customers and for specific operations, although there might be exceptions. As a result, the oil industry hasn't been exactly hurt by the tight money, but it has been slowed down. No let-up is expected in this situation for the next few months.

***Glowing Oil Future Seen by Utility Head . . .*** Nuclear fuel will not supplant oil and coal in the Southwest, according to Donald S. Kennedy, president of the Oklahoma Gas and Electric Co. Speaking before the 39th annual Oklahoma Utilities Association at Oklahoma City, Kennedy said that nuclear fuel will supplement energy derived from coal and hydrocarbons, but it will be many years before it will supplant it.

## LOOKING AHEAD . . .

***Highway Construction Costs Soar . . .*** Latest indications are that cost of constructing the 41,000-mile interstate highway web authorized by Congress, originally estimated at $30 billion, will run well beyond $40 billion, with almost daily upward revisions. The total cost of the broad 13-year program is now expected to top $100 billion. Increased gasoline taxes are expected to eventually make the American motorist take a seriously dim view of the once-shining picture of a network of superhighways lacing the country.

***Colorado 'Four Corners' Sector Booming . . .*** In the "hot" Four Corners area the Colorado sector is figuring more prominently in the state's exploration program. With the advent of good weather operators expect an upsurge of drilling and development along the west flank of the sector. Activities are expected to compare favorably with exploration in the southeastern counties by mid-summer. Meanwhile, exploratory activity shows some decline in the Denver-Julesburg Basin area.

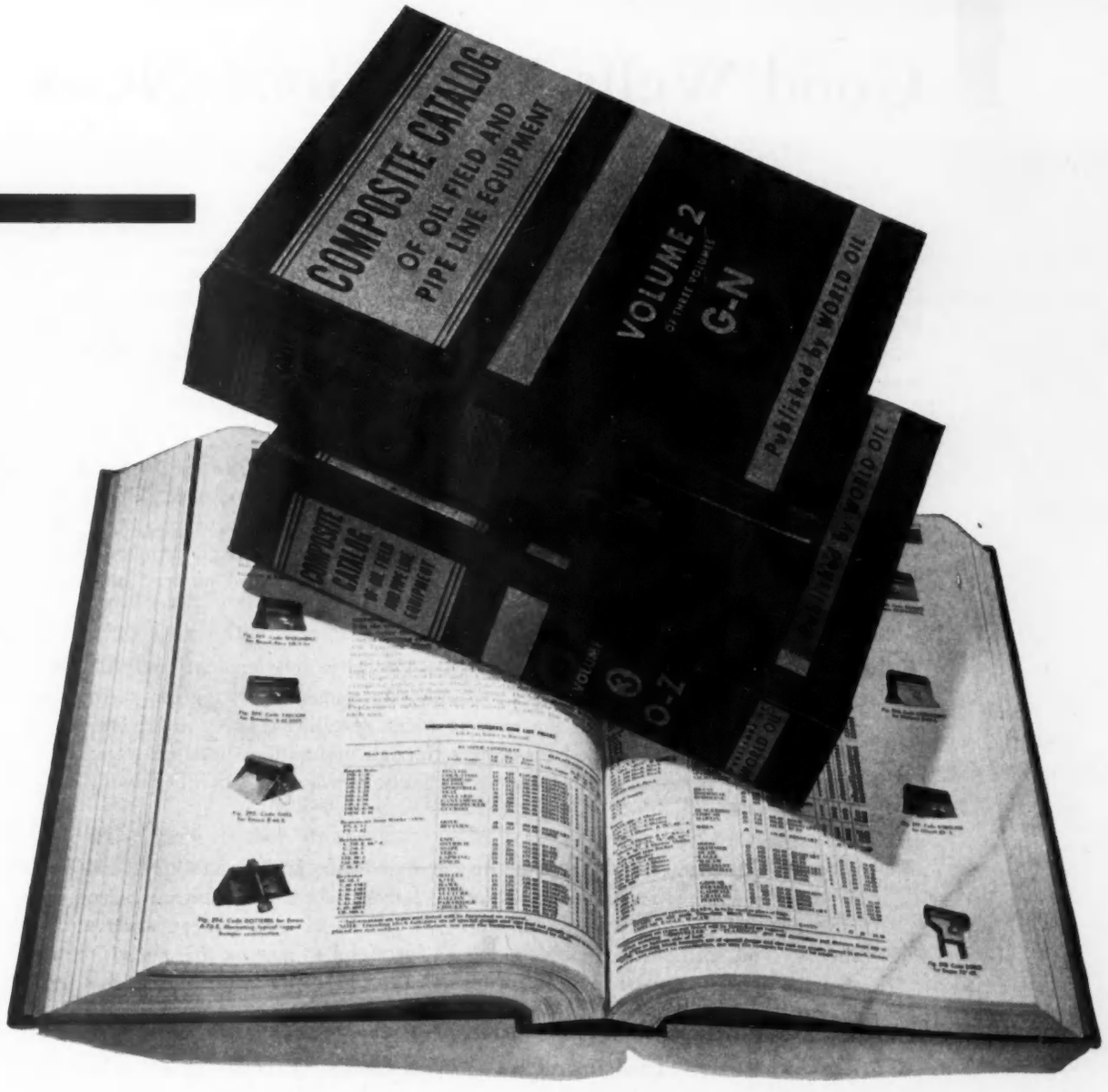
***Seek More Taxes From Foreign Operators . . .*** A move to force American oil companies operating abroad to pay more income tax is shaping up in the Senate. The drive is aimed primarily at four companies operating in Saudi Arabia, but would affect all American companies in foreign fields. Federal income tax paid by Aramco in 1948 amounted to $48 million. In 1955 this figure was only $282,000 because King Saud decided the company should pay him income taxes instead of royalties. The treasury recognized the legality of the transaction because the income taxes paid by a domestic corporation to a foreign country may be deducted from the company's U. S. income tax liability. Senators behind the drive consider this a major "tax loophole" which must be plugged. Observers do not believe the drive will succeed.

***Oklahoma May Increase Gasoline Tax . . .*** Oklahoma state authorities, seeking new sources of revenue, may add another cent to the state's gasoline tax. This would give Oklahoma a total of 7.58 cents plus three cents federal tax, or the highest of any state in the union. If this legislation is passed it will give Oklahoma the dubious distinction of being first in the nation in the amount of gasoline tax paid, since no other state could match a 10.58 cents per gallon tax.

***Decision on Pipe Line Connections Awaited . . .*** The eyes of Mid-Continent producers and pipe line companies are on the Texas Railroad Commission's proceedings on requests that connections be required to all leases in the state. Testimony, so far, has been given by producers who want the Commission to order the connections, or at least to adopt plans that would relieve the operator from paying truck transportation costs. Whatever action is taken by the Texas Railroad Commission will have considerable influence on other regulatory bodies faced with similar complaints from producers without pipe line connections.

***Venezuela May Grant Concessions . . .*** About 1 million acres in concessions, involving between $400 million and $500 million, are expected to be granted by the Venezuelan government this year.

***Tanker Tows Cheaper Than T-2's . . .*** Operation Nobe is the name that has been given to British experimental work on torpedo-shaped nylon containers 600 feet long and 30 feet in diameter that can be towed by a tanker or other type ship and carry as much as 70,000 barrels of oil. About 80 percent of the container would be submerged. Each container would cost about $200,000 to $260,000, which is cheaper than a new T-2 tanker's price tag of about $2.6 million.

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# THE COMPOSITE CATALOG

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For more data on advertised products, use Readers' Service Cards, last page.

# Good Wells Make Good News

**May, 1957**

CEALMENT* is a Dowell-developed cementing service that uses a latex-cement slurry. It has provided successful cement jobs under conditions where ordinary cementing often fails. Here are some examples of what this new, exclusive Dowell cementing service has done for others.

- **Alberta, Canada:** An old well in the Joseph Lake Field had declined in production until operator ordered acid treatment. After treatment, well produced 100 per cent water. Cealment was used to perform Bradenhead squeeze, without packer, to shut off water. After multi-stage squeeze, using 40 barrels latex-cement, complete water shut-off was achieved. After drilling out and reperforating, well pumped allowable

- **Jack County, North Texas** (New Well): Drilled in conglomerate to 5520′. Drill stem tests showed oil at 5450′, water at 5520′. After cementing casing and perforating oil zone, well came in flowing but went to water, revealing channel in cement. Then Dowell was called to squeeze latex-cement through perforations opposite water sand. Result, after reperforating and Mud Acid cleaning, was a 125 BOPD flowing well.

- **Andrews County, West Texas:** An operator in the McFarland Queens field had wells go to water after fracturing. Defective cement jobs were suspected. So, on one well, he used Cealment, tailing in with 500 gallons of latex-cement while setting the 5½″ oil string. This procedure was so successful in solving the water problem that the operator standardized on Cealment to tail in all his oil strings in this field.

- **Calcasieu Parish, Louisiana:** An old well sanded up, indicating the possibility of a hole in the casing. Squeeze testing revealed holes at 4610 and 4624 feet. Cealment was used to patch both holes at the same time. 800 gallons of latex-cement were placed using a squeeze tool above the upper hole. After drilling out, casing was tested to 1200 psi and no leaks were found.

Though the cases presented here deal primarily with remedial work, operators are also finding Cealment has many advantages over common portland for tailing in long strings and setting liners.

For more information or service, call any of the 165 Dowell offices in the United States and Canada; in Venezuela, contact United Oil Well Service. Or write Dowell Incorporated, Tulsa 1, Oklahoma.

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# Oil Cannot Rely on Suez

**Reopening of the Suez Canal** does not end the Mid-East crisis. Actually the basic problem is no nearer a solution today than when Nasser seized the canal last July.

Ahead are months and months of wrangling in an effort to reach a satisfactory compromise agreement on the canal's future operations. But it is extremely doubtful if it will be possible to reach a fully satisfactory solution. How can there be a definite guarantee that the Suez will never be closed again? Until Nasser's sudden unexpected seizure, the world thought Suez would never be closed. Regardless of any agreement this could happen again.

•

**Western Nations must not be lulled** into a false feeling of security because shipping again is moving through the canal. This would be extremely dangerous.

The Free World must have tremendous quantities of oil to prevent economic chaos. With the Middle East now holding three-fourths of all the world's known unproduced oil reserves, the industrial welfare of much of the Free World depends on the availability of Middle East oil. Western Europe's economy in particular has come to be dependent on oil, primarily Middle East oil. This will be increasingly true in the future.

But the repercussions from any stoppage of Middle East oil shipments is world wide. Even the national security of the U. S. would be severely undermined. Therefore, the vulnerability of westward oil shipments from the Middle East is the weakest link in the Free World's economy—also in its military strength.

Since it seems impossible to fully insulate the canal against Egyptian politics, Western nations must find ways to reduce their life-or-death dependence on the Canal. They have no other choice.

•

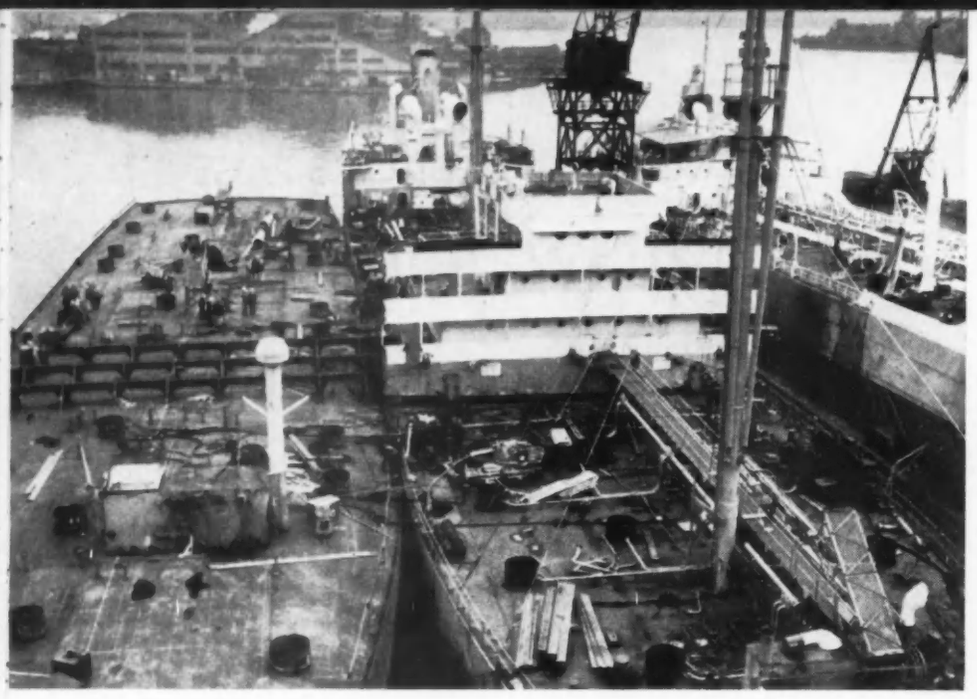
**Oil can play a vital role** in alleviating the Free World's dependence on Suez. It has much at stake. Furthermore, oil has a better opportunity to bypass the canal than most industries.

Oil pipe lines can be built from Middle East producing regions to the eastern end of the Mediterranean Sea. More giant super-tankers also can be built to make shipments around Africa economical.

Politically and militarily, super-tankers have much in their favor. They would be less vulnerable to unfriendly acts. They would be farther from both Russia and Egypt. However, economics must also be considered.

Therefore, both proposals need to be given serious study. A decision should be reached as to which would offer the greatest dependability in the future. Then action should be taken without delay. The governments of Western Europe and the U. S. should actively support any steps to "beat" Suez. Continued dependence on the Suez is too dangerous to be risked.

Warren L. Baker



"Jumboizing". . . Making big tankers out of little ones . . .

# 'Jumboized' T-2 Tankers To Start Operations Soon

**These rebuilt Amoco and Gulf T-2's should prove the degree of feasibility of converting and enlarging aging tankships by adding a new midsection to the hull. Large and relatively quick addition to world tankship capacity is possible if these ships are successful.**

**By H. T. BRUNDAGE**
World Oil Staff

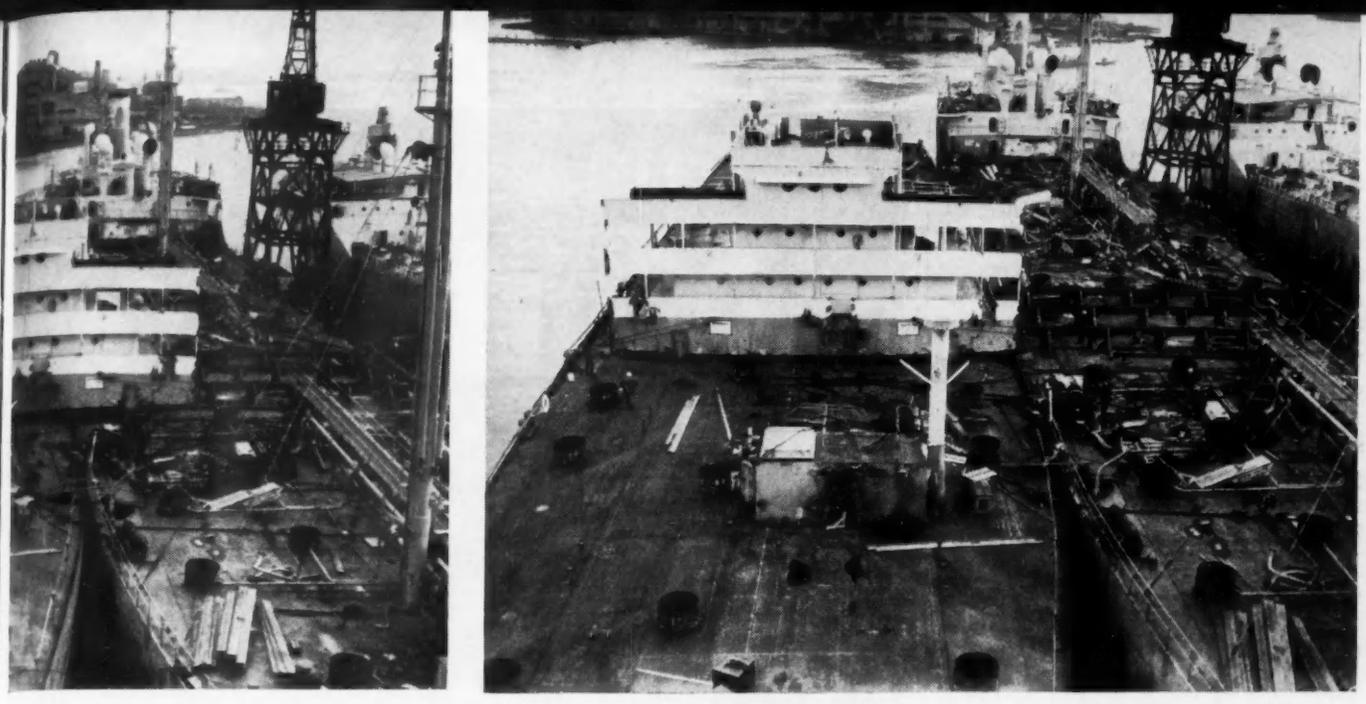
Early in April, the first "jumboized" T-2 tankers to be completed were being readied for sea trials. They will partially foretell results to be expected in a number of multi-million dollar programs to modernize, renovate and expand the capacity of aging T-2 tankers by adding a new center hull section to each.

American Oil Company's *Amoco Delaware* was scheduled to complete its refitting job at Newport News Shipbuilding and Drydocks Company's yard in Newport News, Va., on about April 16.

Gulf Oil Corporation had completed welding of a new midships section to the bow and stern of the old T-2 "Gulfmeadows," and had completed fitting the old superstructure onto the new deck by late March. The ship was renamed "Gulfbeaver" and left Baltimore, empty, for Corpus Christi, where it was scheduled to arrive April 8 or 9. No operational difficulties were reported during the "Gulfbeaver's" maiden empty voyage. It was scheduled to load gasoline at Pontiac Refining Company's terminal at Corpus Christi destined for shipment to an eastern U. S. Gulf port. It is likely that each of the nine T-2's to be jumboized pursuant to Gulf Oil's $25 million program will be named for an animal and may be so identified.

Amoco's program calls for jumboizing four T-2's at Newport News. Gulf planned to enlarge nine of its T-2 tankers. Bethlehem Steel Company is doing Gulf's jumboizing at their yards at Sparrows Point near Baltimore, Md. Virtually all companies owning T-2 tankships, many of them built during World War II and threatened with block obsolescence and the scrap heap, are watching this development carefully. There is every reason to expect that the newly-enlarged T-2's will prove highly successful. If so, virtually all of the 500 war-built T-2's still in service may be considered for jumboizing, provided adequate shipyard time, steel and labor can be made available. The new technique has many advantages.

The term "jumboizing" was conceived by American Oil Company's maritime department to describe a technique to enlarge and renovate old tankers, though the same basic process will no doubt be adapted to dry cargo ships later on. A new cen-



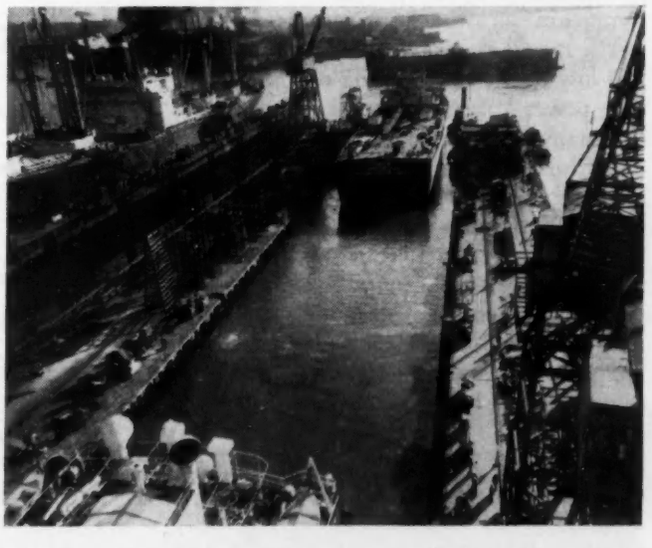
**Hulls are locked together and ballasted twice in order to handle the shifting weight of the 160 ton steel midships house from the old *Gulfmeadows* (tanker on the right) to its new midbody (left). This is one step in the "jumboizing" process which boosts the oil carrying capacity of a T-2 tanker from 140,000 to 175,000 barrels.**

ter hull section, 310 feet long and a maximum of 75 feet wide, is built and launched at Newport News for Amoco before the tanker to be jumboized arrives for renovation. The superstructure is removed from the old ship. Tapered bow and stern sections are cut apart from the amidships section, which is removed and scrapped. Then, bow and stern are fitted and welded to the new midsection, and the superstructure from the old ship is raised and reset as part of the newly-enlarged tanker.

Jumboized T-2 tankers are expected to last another 15 years after this renovation. After completion of the jumboizing process at Newport News, the Amoco *Delaware* and the three other T-2's to follow will be increased in length from 523.6 to 571.6 feet, widened at the beam from 68 to 75 feet, increased in deadweight tonnage from about 16,000 to 20,000; and, most important, increased in carrying capacity from 140,000 to about 175,000 barrels. Experiments with models of the conventional and jumboized T-2 indicate that speed of the altered ship might be reduced from about 14.5 to 14.1 knots, though many maritime engineers and architects think the speed loss will be negligible, in the order of two-tenths of a knot or less. Loaded draft of jumboized T-2's will be about the same as before, 30 feet, 2 inches.

It costs about $2.6 million to jumboize a T-2 in this fashion. Normal renovation of a war-built T-2, essential for steadily-increasing numbers of them to be able to satisfy U. S. Coast Guard and maritime insurance requirements, would cost over $1.25 million. It costs about the same

**The *Gulfmeadows* has been floated stern-first into dry dock and the old middle section and bow have been cut loose from the stern. Heavily ballasted, the detached stern remained on the bottom of the graving dock which was refilled to float midbody and bow out. The discarded midbody eventually went to the scrap heap.**



**While the old midbody and bow move away in the background, the new, longer and larger midbody is floated to the waiting stern (foreground). The stern and new midbody were then welded together. Later the old bow was cut away from the old midbody and welded to the new midbody. This completed the "jumboized" tanker which was renamed *Gulfbeaver*.**

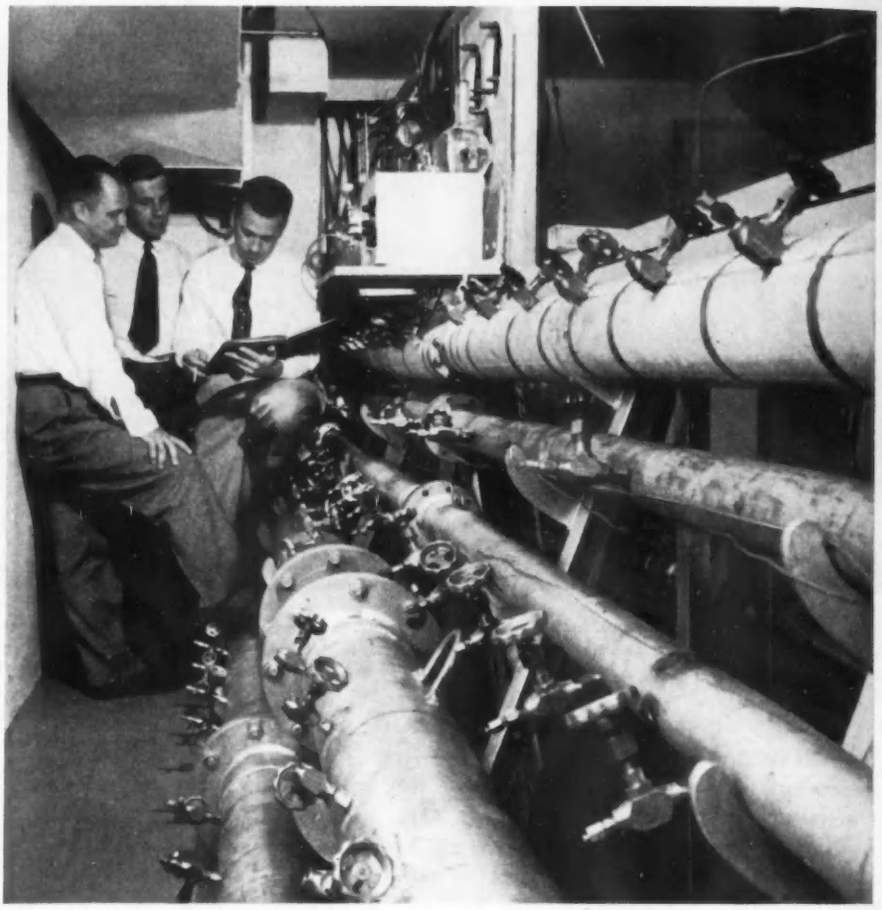
amount to jumboize an old T-2 as to build a brand new one, using much less steel (about 3500 tons in the jumboizing operation) and considerably less time. Long periods are required to get such essential items as turbines, which commonly take a year for delivery. Jumboizing of old tankers seems like a much more efficient use of shipyard time, which is now becoming one of the world's scarce services. Finishing a ship, particularly the midships house, crew's quarters etc., is time-consuming work, largely avoided in the jumboizing operation, in which the old superstructure is essentially lifted off the old hull and put on the new one later.

Jumboizing enhances a tankship's versatility, too. The *Delaware* formerly carried three different grades of cargo, now will be capable of carrying four. The new technique also widens possibilities for combination-cargo carriers, such as ore and oil. It may also be quite feasible to convert a "dirty" T-2 (customarily carrying crude and heavy fuel oil) to a "clean" ship (to carry light oils and gasoline) via the jumboizing process.

Enhancing further the economics of jumboizing is the fact that a tanker need only to be taken out of service about 30 to 80 days. The abrupt rise of tanker rates as a result of the shortage due to the Suez Canal blockage emphasized the need both for greater capacity and to keep existing tankships in service.

If reduced speed proves to be a significant drawback to jumboized T-2's, it will be possible to make up this loss through increasing output of the power plant. General Electric Company is reported to be designing 8500 horsepower marine electric motors for this purpose, as compared with 6600 hp units now powering T-2 tankers. However, marine architects and engineers are generally inclined to wait and see if it will be necessary to install such a boost in jumboized T-2's before instituting a general program to do so.

With nine T-2's slated for the enlargement process and ten new tankers ordered, Gulf Oil Corporation announced in December 1956 that its domestic tanker fleet, through a $114 million program, would be almost doubled in cargo capacity by 1961, to over 770,000 deadweight tons. —**The End**



**Laboratory testing of solvent extraction process included building an "oil field in a pipe." Reservoir conditions were simulated by sealing oil-saturated sandstone cores in steel pipe. The entire extraction process was tried and results recorded.**

# Injected Liquid Propane Boosts Oil Production

**New technique in secondary recovery proves successful in a small field in Seminole area of Oklahoma.**

**Oil production has been increased from 15 to 160 barrels per day.**

**Old reservoir is first repressured with gas so that later-injected liquid propane will not evaporate underground. Then more gas is injected to push the propane and oil toward the wells.**

**By ANTHONY GIBBON,** WORLD OIL Staff

## *This technique might be used in larger fields with even greater success*

GAS-DRIVEN liquid propane is being successfully injected into the host rock to stimulate oil recovery from a depleted formation. The method is being tried by The Carter Oil Company in a pilot experiment in a small field in the Seminole area of Oklahoma.

The new technique is also called a solvent extraction secondary recovery process. Carter investigated its possibilities in the laboratory. The field experiment has been under way for about three years. In application, liquid propane is injected into the depleted formation which has first been repressured with gas. Dry gas is next injected behind the propane, pushing the propane and the oil toward a producing well. In its passage through the formation the solvent builds up an oil bank.

At Carter's pilot plant in Seminole a careful check shows high and steady oil production with a significant reduction in the gas/oil ratio and the return of much of the injected propane. Oil recovery from the small area has increased from 15 barrels per day which were being produced by four wells to 160 barrels per day.

Before applying the technique in the field, Carter's research engineers conducted exhaustive experiments in the laboratory. To simulate field conditions, oil-saturated sandstone was sealed inside an 18-foot section of steel tubing. Into this "oil field in a pipe" measured shots of propane were injected. These were followed by dry gas. The experiments indicated that high oil recovery might be expected with small propane banks. Furthermore, very substantial recoveries of propane could also be obtained.

To conduct its field experiements, Carter selected a small, 26-year-old oil field in the Seminole area where production from the four producing wells had dropped to 15 barrels per day. The productive sands in the field form a narrow band with a thin bottleneck at one end. It was proposed to seal the other end with two water injection wells.

Field preparations began in 1953. Five new wells were drilled, two for water injection, two for propane and gas injection and one new production well. The four old wells were worked over carefully and all factors were carefully analyzed to obtain accurate reservoir test data.

In May, 1953, the four wells were shut in and the zone repressured with dry gas to keep the propane, which was to be injected later, from evaporating underground. When the reservoir zone was repressured, six million gallons of propane were injected under pressure into the formation.

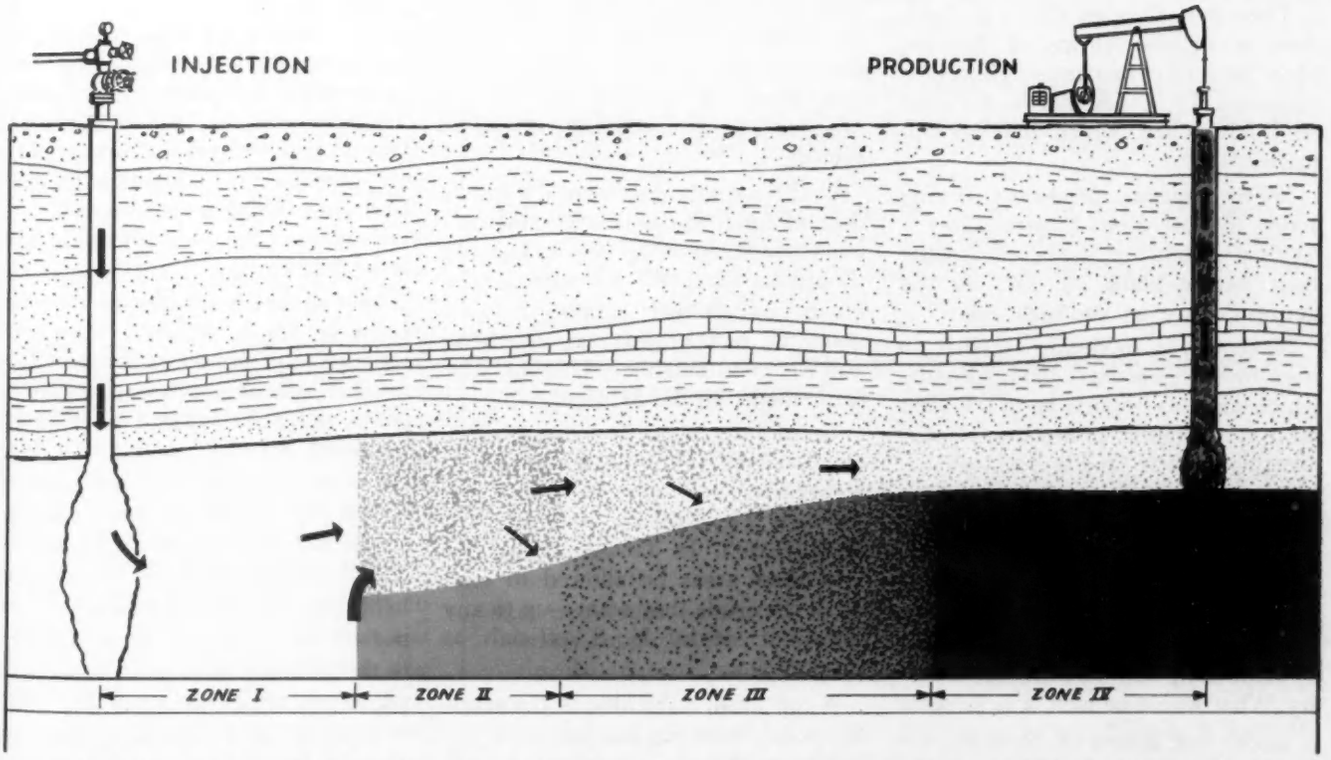
Gas injection followed the propane. By May, 1954, daily oil production from the field attained 160 barrels per day. The gas/oil ratio improved from a previous 7000/1 to 1000/1.

At the present time, three years after the start of the experiment, the zone has yielded more than 118,000 barrels of oil while returning over 35 percent of the injected propane.

Carter engineers are considerably encouraged with results achieved in the Seminole experiment. They feel confident the technique can be successfully applied to larger fields with greater success. Evaluation of the technique continues. When results are all in, computed and analyzed, it is expected the answer will be given as to whether or not the process is economical.

**ACKNOWLEDGMENT**

This technique has been described in a paper entitled, "A Field Test of the Gas-Driven Liquid Propane Method of Oil Recovery," by Dr. George Binder, Loren H. Jenks and J. B. Campbell, The Carter Oil Company, Tulsa, and presented at the annual meeting of AIME held in Los Angeles, October, 1956.




Cross-section diagram of reservoir in Seminole field area where The Carter Oil Company is conducting its field tests of the solvent extraction process for secondary oil recovery. The diagram shows how propane forms bank and is pushed to wells by injected gas.

# Action on Imports Problem May Be Delayed Until 1958

**U. S. government officials are studying proposed quotas and tariffs. But the answer is not easy. They may leave the matter up to Congress when it reexamines the Reciprocal Trade Agreements Act next year.**

**By JOSEPH HUTTLINGER**
Washington, D. C.

Top U. S. officials are cranking up for another effort to hold the line on imports of crude petroleum to the U. S.

This time, Gordon Gray, the new director of the Office of Defense Mobilization, is in charge. He also is chairman of a Cabinet Committee on Fuels Policy, which handles this matter.

With domestic producers urging action to slow down imports, Gray is writing letters to importers asking their future plans. So far, all the figures in are on the high side.

Next step is to decide whether to stick by the February, 1955, formula, which suggests imports be in the 1954 ratio to domestic production. Later, exceptions were made for Canada, Venezuela, and from anywhere into the West Coast.

Ultimately, the ODM could recommend to the President that imports are so high, or threaten to become so high, as to endanger national security by weakening the domestic oil industry. What would be next is to be seen.

Under one school of thought, the President could do little but ask the imports shaved back. Under another, he could do almost anything he wanted—quotas and tariffs included.

**What Type Controls?** While hard and fast controls over imports may not come in the near future, much deep thought is being given to the best form of control to use—if needed. Quotas and tariffs are mentioned.

Under a quota system, much would depend upon the details of how it is worked out. As many see it, Canada should be excepted, as part of the U. S. oil defense supply, because many U. S. operators are up there, and for good neighbor relations. The same might go for Mexico.

In addition, there is a strong tendency to give preferred treatment to Venezuela, and other areas of the Western Hemisphere, and for the same reason. In fact, some suggest that these areas be allowed to send in all the crude they want—up to any top limit set by U. S. officials as proper.

A top limit, naturally, is the starting point, and that has yet to be set, although there is a target in the February, 1955, report of a special Cabinet committee. This target is that imports should be in the same ratio to domestic production as they were during 1954. This was modified last year to except oil from Canada and Venezuela, and crude imports from anywhere in crude-oil short California. The target is not sacred and could be changed by ODM any time.

Assuming a top limit, and assuming that special treatment were given Western Hemisphere areas, there might remain leeway for more crude oil imports, or there might not. If not, that would shut off imports from the Middle East. And, in fact, if the limit were low enough, it might call for an allocation system as to who might bring in oil from Western Hemisphere areas.

**Division Studied.** Assuming an unused part of the over-all figure for imports, the problem arises as to how to divide up the quota between Middle East and other-area imports. In this connection, two main suggestions are made. One is to use history, and the other to use refinery capacity in the U. S.

Neither, perhaps, would be used alone. History must be used as one test, it is generally felt. But this could not be the only test, as it would not allow room for newcomers, and newcomers are part of a dynamic industry. Perhaps, some suggest, 85 percent of the quota should be given to historical importers on the basis of the past, and the rest set aside as a "kitty" to be doled out by appropriate agenices to newcomers. History again has two sides: the importer and the source of the oil. Both would have to be considered.

An elaborate scheme to base imports on U. S. refinery capacity or refinery runs has been proposed by some. Under this, every refiner would get a ticket to import oil, whether his plant is on the East Coast or in the heart of Oklahoma. If he wanted to use the ticket to buy imported crude oil, well and good. If not, he could sell it. After all, this school holds, the economic advantage of imported crude, if any, is as desirable to the inland refiner as to the coastal plant.

Dangers in the refinery base are explained as including the difficulty of rewarding companies which have

made substantial investments abroad to develop crude oil. Maston Nixon of Corpus Christi, however, thinks this is an ideal starting point for any import quota sharing.

**Would Tariffs Work?** The second major route is through tariffs. At present, the import duty, or tax, on crude oil is all but negligible. To slow down imports, a tariff might have to be as high as $1 a barrel or more, say some oil men. And, when the tariff approach is tried, it often strikes at producing areas where we don't like to strike.

Thus, a tariff of $1 a barrel would keep out Canadian oil, it is said. Even a tariff as high as this, it is added, might let in Middle East oil, depending upon tanker rates and other matters. So, the idea of a sliding scale or differential tariff is proposed, depending upon the source of the crude oil.

The sliding scale or the preferential tariff go at odds with U. S. tariff policy and the most favored nation idea. In fact, it was the policy problem that spurred Independent Petroleum Association of America some time ago to suggest a complicated formula of "reciprocity" in tariffs.

Under the IPAA program, countries which buy substantial quantities of goods from the U. S. would be allowed to ship crude oil to the U. S. in greater volume—through a low tariff. Countries buying less, would have less, or no market—due to steep tariffs. This worked out, and not by coincidence, to allow in Western Hemisphere oil, and to all but bar crude oil imports from the Middle East.

At this writing, the U. S. is trying and hoping to avoid any mandatory action. Talks about crude oil imports may go on for months, especially if the Suez Canal continues as a source of friction. Finally, the U. S. may try to stall the whole matter until next year, when Congress once again considers extension of the Reciprocal Trade Agreements Act. This is the act under which the President is directed to keep down oil imports to a point where they do not hurt the domestic oil industry and thus the national security. At the same time, thought is being given to plans and programs. But no control plan has been worked out. —**The End**

# If Oil Could Speak

***If oil could speak it would have many fascinating truths to tell the non-oil public—truths that would win thousands of new friends for the oil industry.***

***But, oil can't speak—you can. You, as an individual, can win many new friends for the oil industry if you will pass the true facts on to your non-oil industry friends.***

***Here are some of those true facts. They are being presented for one purpose: To keep you posted on your industry, so you can tell the story oil is unable to relate.***

***Read these facts. You will find them informative—and interesting.***

**"If Oil Could Speak" it would tell the American public:**

•

- To fill a medium-sized oil tank ship would require the liquid cargo of nearly eight hundred of the big clipper trucks that haul oil on highways and at airports.

•

- One large steel-producing company burns enough petroleum fuel in one year to heat a five-room house for 380 centuries!

•

- Petroleum and its products make up the largest category of barge shipments, followed in order by coal, sulfur, chemicals, iron and steel, sand and gravel, and grain.

•

- The service station is one of the greatest points of sale in America today—more than 12 billion dollars' worth of high-quality products flow through these "islands" every year.

•

- The energy obtained yearly from crude oil and natural gas is the equivalent of the work of 33 servants for every man, woman, and child in the nation.

•

- A recent survey of 33,537 irrigation wells in the high plains area of Texas shows that 46 percent use liquefied petroleum gas, 35 percent run with natural gas, and the remainder operate with gasoline, diesel fuel, or electricity.

•

- One out of every four floor furnaces sold in America last year was built to operate on liquefied petroleum gas.

•

- The six busiest airports in the United States are paved with petroleum asphalt. Ranked according to volume of operations, they are: Chicago's Midway, New York's La Guardia, Washington's National, Los Angeles, San Francisco, and Miami.

•

- A petroleum refinery is almost a city within itself. It has its own water supply, electricity, and natural gas for fuel. It also has its own fire department, medical department, and maintenance staff.

•

- A medium-power turbo-jet aircraft engine burns its own weight of petroleum fuel every twenty minutes.

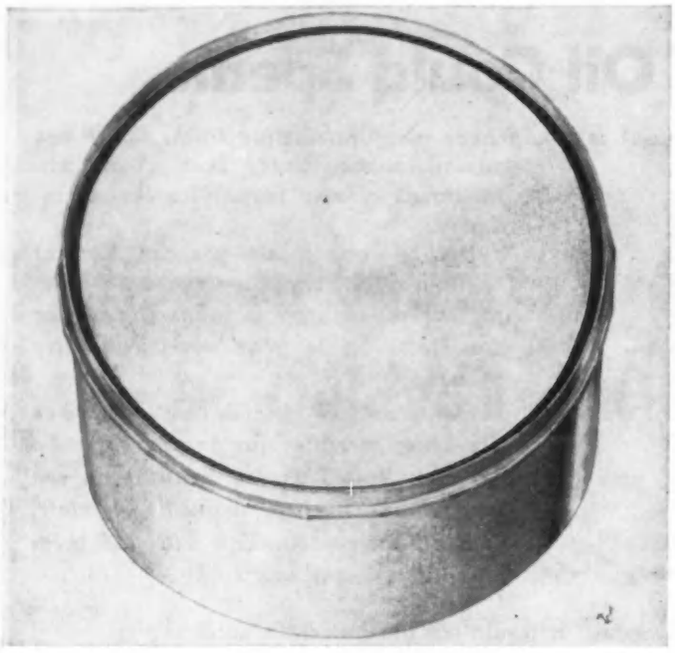


FIGURE 1—This modern roof has underseal hangers and very few connections above the seal—the type most often ignited by lightning.

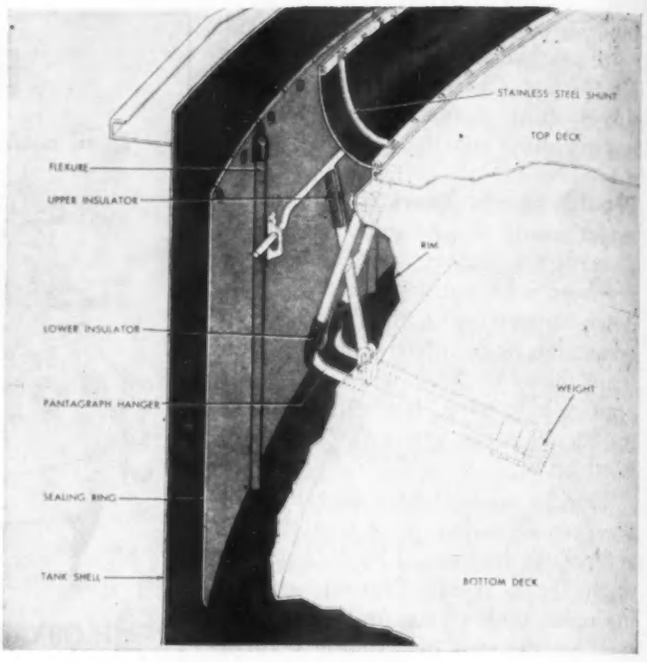



FIGURE 2—Shown above is example of older roofs with hanger contacts above seal and many points of bleed off to the atmosphere.

**Safety and Fire Protection—Part 4**

# Controlling Floating Roof Tank Fires

**Caused chiefly by lightning, this type of fire is easy to prevent—and to extinguish.**

**By J. L. RISINGER**
Maplewood, N. J.

FLOATING ROOF TANKS are designed to eliminate open oil surfaces from which vapors escape. Since open surfaces are eliminated in most instances, the probability of fire from static electricity charge is prevented as long as the roof is floating.

A few rim fires have occurred in these tanks when seals were in poor repair. There has been one claim of ignition from iron sulfide accumulation above the roof from storage of high sulfur content crude oil. This was claimed to have occurred when the roof was down in the tank for a considerable length of time.

No fires have been reported from static charge accumulation on the surface of the oil. However, it is to be kept in mind that this is highly possible when the roof is not afloat and when pumping in or agitating an oil in its vapor pressure range of temperature so as to produce an explosive vapor air mixture. Illustrative of this is gasoline below 10° F., aviation gasoline below 30° F., J.P.-4 from 10° F. to 80° F., and kerosine between 110° and 210° F. It can be seen that the one most often within the vapor pressure explosive mixture range is J.P.-4.

**How to Prevent J.P.-4 Fires.** To prevent fires in floating roof tanks in which J.P.-4 is stored, special precautions are required to prevent rapid charge accumulation during initial pumping until the roof has been floated. This filling should be done with no water bottom, and by gravity flow or very slow pumping in rate. Once the roof is afloat with these products, which at normal tem-

peratures are blanketed with a vapor-air mixture within the explosive range, the tank should not be pumped to below the floating depth of the roof except for cleaning or repairs.

Crude oil has not been known to accumulate a static charge on its surface faster than it can normally bleed off to the shell of the tank. Therefore, these precautions do not appear to be necessary even though the specific crude oil should have a vapor pressure conducive to explosive vapor-air mixtures near its surface.

**Lightning Ignition of Floating Roof Tanks.** For a period of years after the advent of the floating roof no fires were reported in these tanks from lightning ignition.

In recent years quite a few floating roof rim fires have been ignited by lightning. It might be assumed that the reason for this is the increased number of floating roofs. However, the proportionate number of lightning ignited fires is several times greater in recent years than formerly. To arrive at the real reason, the phenomena of lightning must be applied to the design and construction of the early floating roofs and those of recent years.

A few findings taken chiefly from the National Bureau of Standards Handbook H 40 will establish sufficient lightning phenomena on which to base corrective measures for the prevention of lightning ignition of floating roof rim fires.

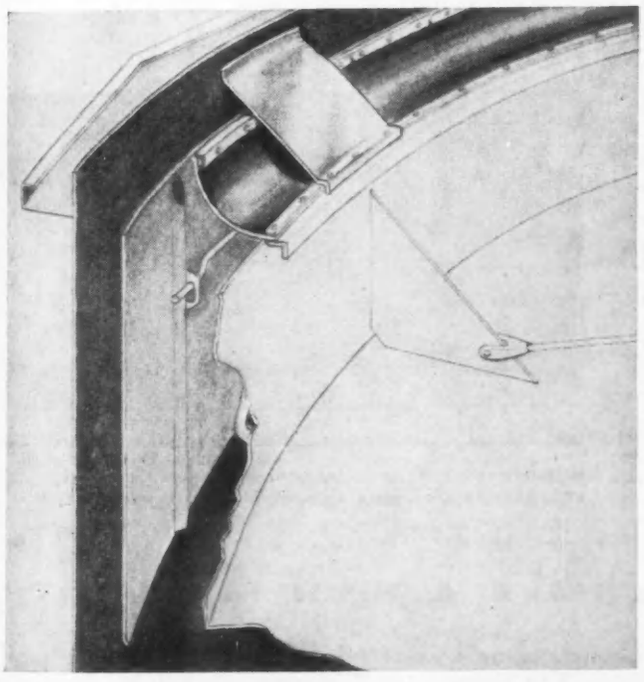


**FIGURE 3—The drawing above illustrates a roof with wide bands extending from roof to shell. Tests are being run on effectiveness of a sufficient number of wide strips of steel welded to the edge of the roof bridging the seal and pressing against the shell of the tank.**

**Hazards of Streak Lightning.** The secondary or induced effects from "streak" or chain lightning are responsible for a large majority of fires that occur in oil tanks, reservoirs and oil tank farms. These occur as a result of sparks produced in or about the tanks where burning vapor air mixtures exist.

Traveling on a conductor, streak lightning has a charge of such magnitude and force as to lead to the conclusion that it and its induced charges do not necessarily follow the path of least resistance to ground or other objects, but the nearest path to the greatest attraction. It appears that neither streak lightning nor a heavy induced charge from its flashes will turn sudden corners or go back in the direction from which it came, even if a considerable jump is required to another conductor leading in the same direction of its travel.

From this data it is possible to calculate the potentials which may be attained, and the values of change in potential gradient due to lightning flashes. In the case of a tank roof floating on the non-conductor oil and in the immediate vicinity of the flash where side flashes have been observed to jump several feet from small insulated metallic surfaces, the values of change in potential gradient would be difficult to calculate. Likewise, it would be difficult to calculate the number and capacity of contacts from the roof to the shell that would be necessary to prevent a side flash jump.

Even in the case of reservoirs and oil tanks inherently grounded, induced effects of lightning are accredited with ignition of a large majority of fires as a result of sparks produced in or about the tanks where escaping gases can be ignited.

**Value of Hanging Roofs and Projections.** In Figure 1, the seal of the floating roof has been added. The ladder and hangers have been placed. These would take care of lightning induced charges only on the roof. However, charges of considerable magnitude would no doubt jump between roof and shell under the seal, or meet with sufficient resistance along the hanger to produce a high enough temperature to ignite vapors in the explosive range. This drawing brings the completely insulated metal body—the roof—to an approach of the modern floating roof in which a majority of lightning ignited rim fires have occurred.

In the early history of floating roofs there were few lightning ignited rim fires in floating roof tanks. A study of the first floating roofs reveal that there were more hangers, and these hangers were above the seal. (See Figure 2). Most of the roofs had a network of pipes and projections from the roof, and many had wire connections extending from these pipes to hangers. Many of the modern roofs also have these pipes and some the wire connections.

Some of the old roofs had such a network of wires above the roof as to resemble the Farady cage. Comparing this type of roof with Figure 1, it can be concluded that lightning ignited rim fires in floating roof tanks have increased with the reduction in the number and capacitance of direct contacts between the roof and the shell of the tank above the seal. The same is true with projections from the roof which might bleed off the induced charge to the atmosphere.

Perhaps floating roof rim fires have occurred from direct hits which ignited leaking vapors when roofs were near the tap. But evidence strongly indicates that all, or all but a few, of these fires have resulted from induced charges on roofs not sufficiently in direct channel contact above the seals of the tanks.

In a study of these ignitions observers have noted the

# Shooting Tests

From the test results shown here, it is evident that the 2⅛" Capsule-Jet can be utilized in all types of well completions requiring a shaped charge perforator.



Penetrations, as shown and described in both the target and the illustration, were obtained in cured neat cement.

## CAPSULE-JET PERFORATIONS HAVE A HIGH FLOW RATE

The introduction of the expendable perforator by Schlumberger in 1951 opened an entirely new field of well completion practices. From the research and engineering laboratories of Schlumberger, now comes the latest and best in shaped-charge perforators . . . the New Capsule-Jet.

The Capsule-Jet is a thru-tubing expendable perforator in two sizes, 2⅛" and 1-11/16". The design features four or five shots per foot, phased at 90°.

This gun gives greater penetration than any thru-tubing perforator on the market and equals that achieved with the larger 4-inch carriers. The Capsule-Jet is designed to give its maximum formation penetration irrespective of the gun's position in casings up to 7½". This feature is important since the gun generally fires while lying on one side of the pipe.

The Capsule-Jet Perforator gives large, uniform holes to maximum penetration . . . holes that are even larger than the casing holes. The very shape of this perforation practically eliminates plugging—with either remnants of the charge or pulverized sand.

The new Capsule-Jet—with its deep penetration, large casing hole and large uniform formation hole—makes a perforation with superior flow characteristics, proved beyond any doubt in Schlumberger's high-pressure, temperature and flow laboratories.

Write for complete details or ask your Schlumberger engineer to give you additional information on *the best and most powerful thru-tubing gun in the field today!*

**SCHLUMBERGER** WELL SURVEYING CORPORATION

Schlumberger . . . Engineering for Better Service.

# Prove Superior Charge Design

## The NEW Schlumberger CAPSULE-JET PERFORATOR

**For deep effective perforations that have a high flow index . . .**
**USE THE SCHLUMBERGER CAPSULE-JET**

Check these other outstanding features . . .

Designed to give maximum formation penetration regardless of gun's position in the pipe.

Breaks up into small pieces, and will not obstruct further runs.

It leaves a minimum of debris—The debris from one foot of gun will fill only *one inch* of 5½" casing.

It is extremely flexible . . . allows easy handling of long sections of guns . . . will pass through kinks in the tubing.

It can be assembled with blank spacers to facilitate spacing of shots.

100 feet or 400 shots can be run on one trip in the well.

It can be run in pressures up to 12,500 p.s.i. and temperatures of 325°F.

It leaves no slug or debris in the perforation.

### MINIMUM OF DEBRIS

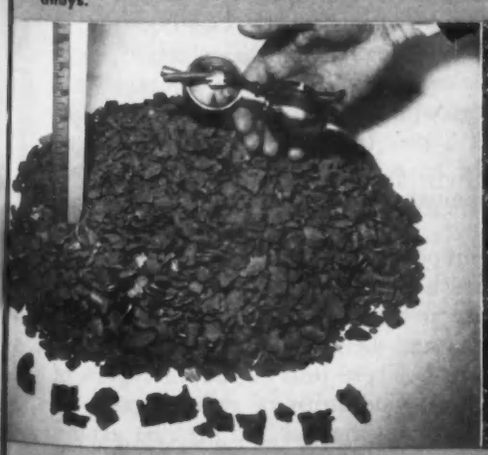
The Capsule-Jet leaves a minimum of debris—just one-half the amount of the tubular guns. The capsule charge cases are made of a special die cast aluminum alloy developed by Schlumberger. The high strength and extremely low ductility of this alloy result in a case which withstands high pressures and has excellent break-up characteristics. The debris from this gun may be dissolved with the same ease as regular aluminum alloys.

### MAXIMUM FLEXIBILITY

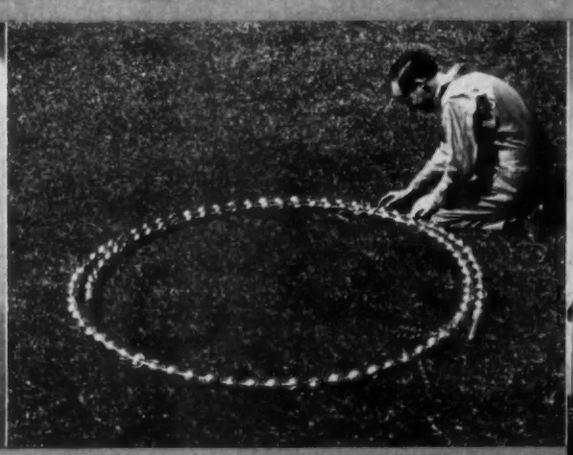
The Capsule-Jet is designed with a minimum flexing radius of three feet. This flexibility allows the tool to be run through crooked or cork-screwed tubing without difficulties. Even though this tool is designed for maximum flexibility, charge case linkages are built for strength and durability. They will withstand a pull of 1000 lbs. without shearing.

### LENGTHS UP TO 100 FEET

The Capsule-Jet gun can be run in lengths up to 100 feet. The flexibility of this gun will allow long sections to be fed into the riser assembly without the necessity of having to install a high mast or derrick on the well.



The debris from a 13-foot gun (52 charges) recovered from a well in Lea County, New Mexico. Two charges are shown for comparison.



Gun curved into a 3' flexing radius.

Capsule-Jet being fed into riser from the working platform of a portable derrick.

## FACTS YOU SHOULD KNOW ABOUT FLOATING ROOF TANK FIRES

1. **The chief cause of floating roof rim fires is lightning.**

2. **However, few if any floating roof rim fires are the result of direct lightning strikes. Most, if not all, lightning ignited floating roof rim fires result from induced charges on the roof, which in the immediate vicinity of the thunder storm, may reach a potential gradient immediately after a flash comparable to the appearance of a direct hit.**

3. **Lightning ignited rim fires in floating roof tanks have increased with changes in design. The changes have reduced the number and capacitance of direct contacts between the roof and shell of the tank above the roofs or contained seal, and projections and cross wires above the roof contacting the shell of the tank.**

4. **To prevent lightning ignition of floating roof rim fires, establish on those roofs not having them the required number and capacity of direct and straight channeled contacts between the roof and shell of the tank. In tanks with under seal, vapors bridge the seal with these contacts.**

5. **The providing of a Farady Cage on a floating roof might reduce the ignition. However, the most feasible method of preventing ignitions appears to be the establishment of contacts between the roof and shell above the gas tight seal.**

6. **Floating roof rim fires can be effectively fought and easily extinguished with portable equipment. The ease with which these fires can be extinguished is dependent upon the attack of the fire before large sections, or all of the seal has burned out.**

flash on the tanks, sometimes even hearing the clap. None have reported seeing the streak leave the cloud and strike the tank. The reaction at ignition of these floating roof rim fires also support the induced charge conclusions.

In one case where six crude oil tanks of a group of 12 were ignited simultaneously when a low hanging electrically charged cloud passed over them, the seal of the floating roof of one of the tanks blew out at six places around the tank. These roofs were of the under seal hanger type. No doubt flame occurred simultaneously under the seal at these six points.

**Preventive Measures.** When the rim fires in floating roof tanks began to increase in number, it was thought that extensive grounding of the tank and the providing of bond wires from the roof of the tank to the shell would solve the problem. Neither of these had any noticeable effect on the number of ignitions.

In fact, in a heavy lightning area a floating roof gasoline tank was ignited at the rim by lightning. It was a double-deck, pantagraph, under seal hanger type roof and the explosion under the seal blew out about a third of it and actually bulged the shell of the tank, and bent the roof at the point of explosion. The tank was repaired, heavily grounded with auxiliary ground wires and pipe driven to constantly wet soil. The recommended bonding cables from roof to shell were installed and the tank put back into service.

One month later the tank was again ignited during an electrical storm in the same manner as before. The six crude oil tanks that were ignited simultaneously were grounded and equipped with bonding cables from roof to shell.

After these fires, grounds and bonds were tested and there was no greater resistance between the roof and shell when they were disconnected than with them connected. However, they were left connected, tanks repaired and put back into service.

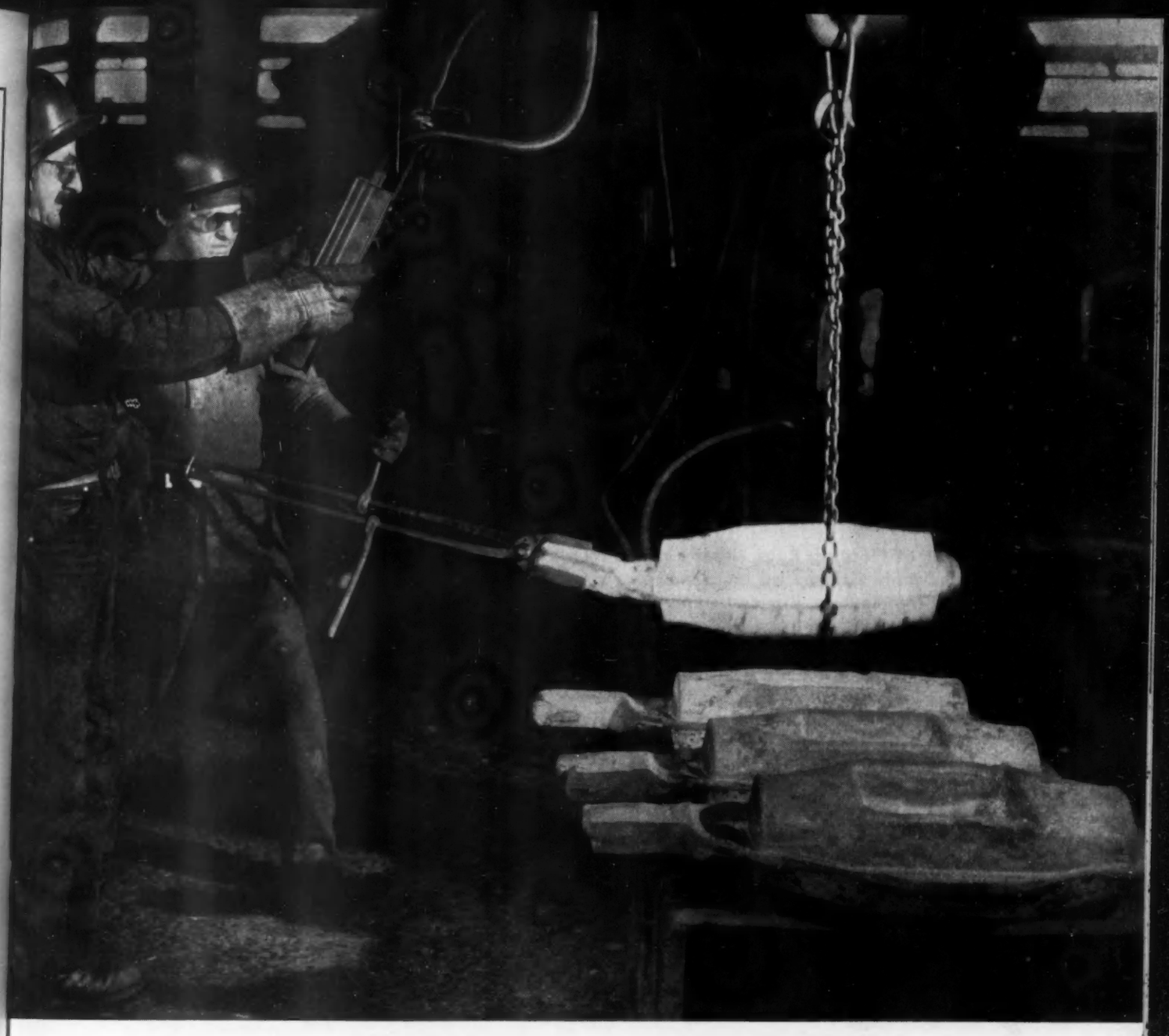
Twenty-six days later during an electrical storm, one of the tanks was ignited again. The added contacts from roof to shell may have reduced chances for ignition as a result of induced charges, especially light ones. However, they did not do the total job of preventing them.

Experience indicates that even where the roof hangers are above the seal, they—together with the ladder—are not enough to provide a sufficient area of connection at the right places to prevent all fires. Neither will the auxiliary cable and wire bonding provide the contact required. Also, grounding of the tank itself will not greatly influence the number of lightning ignitions of these tanks.

No doubt if the seal itself was of effective conductive material, the lightning ignitions would be reduced provided the seal was kept in good repair. However, no material has been found out of which to build seals that have as little resistance as metals. Therefore, there might be sufficient resistance in the seal to cause it to be ripped open.

Some companies build floating roofs in which a rim of steel presses directly against the shell of the tank as a shoe or hanger under which the seal itself extends below liquid level. This is a new type and there has not been sufficient experience to substantiate that they will not become lightning ignited. However, none have occurred in these tanks to date, and their construction would indicate that such ignitions should be very rare, if ever.

Extensive tests are being made by one manufacturer to determine the best methods to provide necessary contacts between the roof and shell of tanks that do not have contacts above the seal. These tests include a system of a sufficient number of wide strips of stainless steel attached to the roof, bridging the seal and pressing against



# This Time It Was Turnbuckles

One thing that makes drop forging an interesting business is the immense variety of items that come from the hammers. On Monday it may be steam-trap bodies, hand wrenches, and cranks. On Tuesday perhaps spring hangers, parts for oil-well bits, gear blanks, strut forgings. The rest of the week, almost anything you can think of within the limits of drop-forge capacity.

Bethlehem has manufactured so many types of drop forgings that it's impossible to list them all. When the photograph above was taken, some turnbuckles were having their inning. The picture shows you a few of the rough forgings just after leaving the hammer. Each weighed better than 200 lb.

These were relatively large pieces, but Bethlehem often makes drop forgings that run heavier—and of course, many that are smaller. Our range is from approximately one lb to 250 lb; our range of designs, just about limitless.

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the shell above it. If a sufficient number of these are used it is believed they will serve the purpose (See Figure 3).

Steel strips are not required on roofs where there are multiple contacts between the roof and shell of the tank above a tight seal, or if a sufficient number and capacity of contacts are under the seal which rests directly on the surface of the tank. It is to be kept in mind, however, that oil is insulating and current will not travel as readily along the surface of a metal submerged in oil as in the atmosphere.

In figuring the justification for the extra construction and design required as precautions against ignitions of floating roof rim fires on the graded risk basis, consideration should be given to:

- Standard design of the roof.
- The height of structures in the vicinity of the tank.
- The frequency of thunderstorms in the region.

**Extinguishment of Floating Roof Fires.** Floating roof rim fires can be easily extinguished by use of foam hose nozzles from the top platform, driving the fire away from beneath the platform with the foam, fog, or dry chemical and then proceeding around the tank.

In heavy lightning areas some companies place a line with a Y-connection, with valves on each angle of the Y, so that foam, started from ground level, will drop from the bottom line of the Y onto the seal below the platform and extinguish the fire at that point. Then the fire fighters can mount the steps and platform, connect a hose to the top line of the Y, open the valve on the line, close the valve on the bottom line, and then extinguish the remainder of the rim fire from the roof of the tank by use of the foam line and nozzle.

Rim fires have been successfully fought with dry chemical extinguishers, in sizes in accordance with the size of the fire—also by sliding a light foam tower (applicator) around the tank to cover the seal where burning. If this method is to be used, attention should be given in advance to see that the croak of the tower is wide enough to span the wind girder.

Other companies are building a walkway around the tank below the tap. From these walkways the rim fires can be easily extinguished by use of portable equipment. Some have allowed the fires to continue to burn until the tank was completely lost because of the fear of getting on the roof to extinguish the fire.

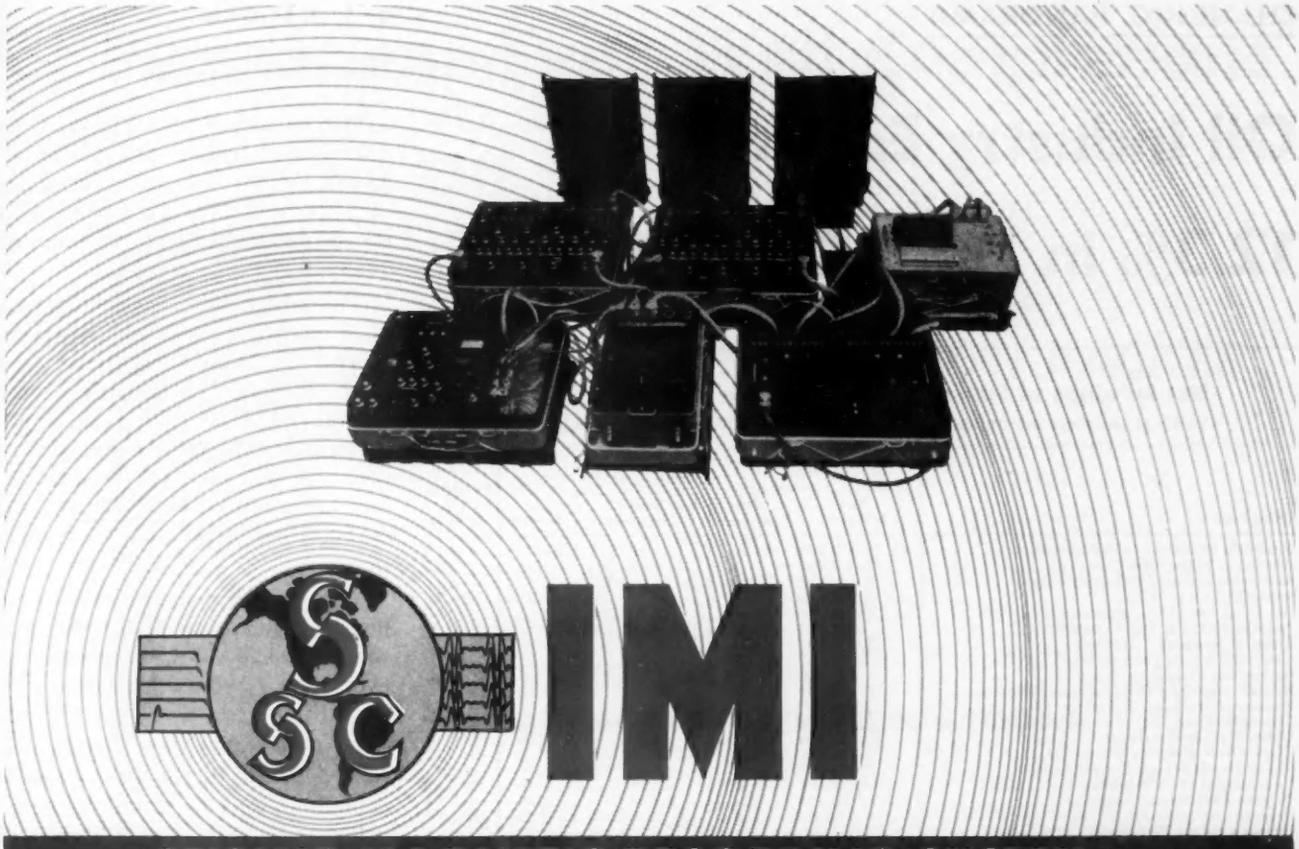
If the fire can be extinguished and kept extinguished around the ladder, especially on pontoon and double deck roofs, the fire can be safely fought from the roof unless the complete seal is on fire and the roof is so low that flames and smoke are too severe on the fire fighter.

If the fire is to be extinguished with dry chemical, and the rim is on fire around the entire roof, two men should attack the fire simultaneously in team work, starting together, then going in opposite directions and meeting at the opposite side of the tank.

It is best to plan the fighting of these fires in advance of their occurrence, and better still to prevent the fires so that plans will not have to be put into execution.

Wide World Photo

**COSTLY WRECKAGE—'Mr. Gus,' the $3.5 million offshore drilling rig, owned by Glasscock Drilling Company, lies on its side in some 35 feet of water in the Gulf of Mexico. The rig toppled over as it was being moved to a new location. The rig was about 35 miles south of Corpus Christi, Texas, and three miles off Padre Island. High winds and seas prevented driving of piling which might have saved the rig. For more about Mr. Gus, see Page 138 of the Special Offshore Report in this issue.**



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# Oil Industry Earnings Up 12.3% in 1956 Over 1955

By L. J. LOGAN

World Oil Staff

Seventy-four oil companies reported combined net income of $3,879,155,687 for 1956, an increase of $426 million or 12.3 percent over the $3,453,229,522 they earned in 1955.

The companies are predominantly U. S. concerns. But also included are several Canadian companies and the large Royal Dutch-Shell group. Among the U. S. companies are the "internationals" as well as domestic concerns. The composite results therefore are a reflection of the worldwide oil industry as well as U. S. operations.

The 12.3 percent increase in earnings in 1956 approximately duplicated the gain of about 15 percent in 1955 over 1954. (World Oil, May, 1956, Page 84.)

In 1956 relatively better results were achieved by the international oil companies than by the U. S. domestic operators. The Royal Dutch-Shell group registered about the same increase in earnings as the 12.3 percent gain for the 74 companies in the aggregate. Increases for other internationals included 30.0 percent for Gulf Oil Corporation, 19.8 percent for Socony Mobil Oil Company, 15.9 percent for Standard Oil Company of California, 14.0 percent for Standard Oil Company (New Jersey), and 15.0 percent for The Texas Company.

Some domestic companies, especially integrated concerns, showed average or better than average increases in earnings in 1956. These gains included those of 18.4 percent for Anderson-Prichard Oil Corporation, 19.6 percent for Atlantic Refining Company, 21.9 percent for British American Oil Company, 35.2 percent for Champlin Oil & Refining Company (formerly the Chicago Corporation), 26.1 percent for Cities Service Company, 15.5 percent for Plymouth Oil Company, 15.6 percent for Standard Oil Company (Ohio), 16.3 percent for Sun Oil Company, 14.8 percent for Sunray Mid-Continental Oil Corporation.

Most of the other domestic integrated companies and the domestic refiners and producers registered earnings increases less than 12 percent or decreases in earnings. Eighteen companies showed decreases.

**Net Earnings of Some Oil Companies in 1956 and 1955**

(Earnings per share are on basis of common shares outstanding December 31, 1956)

| COMPANY | 1956 Net Income | 1956 Per Share | 1955 Net Income | 1955 Per Share | Percent Diff. In 1956 |
|---|---|---|---|---|---|
| Amerada Petroleum Corporation | $ 26,499,395 | $4.20 | $ 25,363,673 | $4.02 | + 4.5 |
| American Maracaibo Company | 2,565,004 | .73 | 2,165,056 | .61 | + 18.5 |
| Anderson-Prichard Oil Corporation | 5,880,382 | 3.41 | 4,965,220 | 3.02 | + 18.4 |
| Argo Oil Corporation | 4,508,658 | 2.27 | 4,409,299 | 2.22 | + 2.3 |
| Arkansas Fuel Oil Corporation | 7,524,933 | 1.98 | 8,224,353 | 2.16 | — 8.5 |
| Associated Oil & Gas Company | 605,473 | .23 | **Loss 289,726** | .... | .... |
| Atlantic Refining Company | 47,209,884 | 5.11 | 39,464,168 | 4.25 | + 19.6 |
| Aztec Oil & Gas Company | 626,082 | .27 | 528,563 | .23 | + 18.4 |
| Bishop Oil Company | 437,556 | .78 | 534,093 | .95 | — 18.1 |
| British American Oil Company, Limited | 25,134,091 | 1.36 | 20,613,219 | 1.12 | + 21.9 |
| Buckeye Pipe Line Company | 2,954,212 | 2.25 | 2,242,027 | 1.71 | + 31.8 |
| Champlin Oil & Ref. Co. (was Chicago Corp.) | 9,479,241 | 2.28 | 7,009,136 | 1.67 | + 35.2 |
| Cities Service Company | 62,151,985 | 6.03 | 49,306,516 | 4.78 | + 26.1 |
| Clark Oil & Refining Corporation | 2,486,021 | 1.95 | 1,436,868 | 1.13 | + 73.0 |
| Colorado Oil & Gas Corporation | 2,681,601 | .70 | 1,363,609 | .26 | + 96.7 |
| Continental Oil Company | 51,817,461 | 5.30 | 46,358,772 | 4.74 | + 11.8 |
| *Creole Petroleum Corporation | 336,433,655 | 4.34 | 292,943,913 | 3.78 | + 14.8 |
| Crescent Corporation | 524,000 | .38 | 2,404,000 | 1.74 | — 78.2 |
| Crown Central Petroleum Corporation | 1,567,236 | 1.90 | 1,723,596 | 2.09 | — 9.1 |
| Delhi-Taylor Oil Corporation | 2,043,368 | .38 | 1,646,795 | .31 | + 24.1 |
| Fifteen Oil Company | 1,005,127 | .78 | 841,671 | .65 | + 19.4 |
| Getty Oil Company | 7,887,947 | 1.28 | †11,182,071 | 1.85 | — 29.5 |
| Gulf Oil Corporation | 282,658,087 | 9.54 | 218,063,510 | 7.36 | + 30.0 |
| Honolulu Oil Corporation | 13,816,268 | 3.68 | 13,699,264 | 3.65 | + 0.9 |
| *Humble Oil & Refining Company | 178,961,132 | 4.99 | 174,997,482 | 4.88 | + 2.3 |
| *Imperial Oil, Ltd. | 69,098,692 | 2.20 | 62,145,140 | 1.98 | + 11.2 |
| *International Petroleum Company | 38,247,126 | 2.63 | 35,064,672 | 2.41 | + 8.8 |
| Kern County Land Company | 11,744,649 | 2.93 | 11,804,411 | 2.95 | — 0.5 |
| Louisiana Land & Exploration Company | 14,649,473 | 1.64 | 13,438,505 | 1.50 | + 9.0 |
| MacMillan Petroleum Corporation | 164,045 | .16 | 68,032 | .07 | + 41.1 |
| Maracaibo Oil Exploration Corporation | 562,197 | 1.14 | 380,001 | .77 | + 47.9 |
| McColl-Frontenac Oil, Ltd. | 12,765,028 | 3.95 | 10,283,094 | 3.85 | + 24.1 |
| Midwest Oil Corporation | 6,559,264 | 2.57 | 5,993,566 | 2.35 | + 9.4 |
| Mission Corporation | 5,799,997 | 1.41 | 5,741,916 | 1.39 | + 1.0 |
| Mission Development Company | **Loss 25,089** | .... | **Loss 86,229** | .... | .... |
| Mississippi River Fuel Corporation | 8,162,183 | 2.33 | 6,847,734 | 1.95 | + 19.2 |
| Oceanic Oil Company | 440,594 | .24 | 73,531 | .04 | +499.2 |
| Ohio Oil Company | 41,215,655 | 3.14 | 41,255,462 | 3.14 | — 0.1 |
| Olin Oil & Gas Corporation | 1,945,846 | .11 | 239,204 | .09 | +713.5 |
| Phillips Petroleum Company | 95,202,615 | 2.77 | 95,203,057 | 2.77 | — 0.01 |
| Plymouth Oil Company | 7,955,588 | 3.22 | 6,888,169 | 2.79 | + 15.5 |
| Pure Oil Company | 36,559,879 | 4.26 | 35,164,226 | 4.10 | + 4.0 |
| Quaker State Oil Refining Corporation | 1,975,257 | 2.39 | 2,676,255 | 3.24 | — 26.1 |
| Reserve Oil & Gas Company | 811,659 | 0.70 | 1,200,335 | 1.04 | — 33.2 |
| Richfield Oil Corporation | 26,573,621 | 6.64 | 29,609,448 | 7.40 | — 10.3 |
| Royal Dutch Petroleum Company | 302,400,000 | 4.97 | 268,800,000 | 4.42 | + 12.5 |
| Royalite Oil Company Ltd. | 1,060,835 | .27 | 1,043,437 | .27 | + 1.7 |
| Ryan Consolidated Petroleum Corporation | 74,177 | .15 | **Loss 25,072** | .... | .... |
| Seaboard Oil Company | 9,368,842 | 2.56 | 8,440,810 | 2.31 | + 11.0 |
| Shamrock Oil & Gas Company | 9,012,100 | 3.92 | 7,747,600 | 3.37 | + 16.3 |
| Shell Oil Company | 135,847,693 | 4.49 | 125,531,950 | 4.14 | + 8.2 |
| Shell Transport & Trading Company, Ltd. | 201,000,000 | 2.46 | 179,000,000 | 2.19 | + 12.3 |
| Signal Oil & Gas Company | 10,694,000 | 2.61 | 9,640,400 | 2.35 | + 10.9 |
| Sinclair Oil Corporation | 91,070,812 | 6.17 | 80,709,954 | 5.21 | + 12.8 |
| Skelly Oil Company | 34,093,414 | 5.93 | 32,240,262 | 5.61 | + 5.7 |
| Socony Mobil Oil Company | 249,503,667 | 5.70 | 208,347,039 | 4.76 | + 19.8 |
| South Penn Oil Company | 6,028,056 | 3.77 | 4,674,617 | 2.93 | — 22.5 |
| Standard Oil Company of California | 267,890,801 | 4.24 | 231,138,655 | 3.66 | + 15.9 |
| Standard Oil Company (Indiana) | 149,431,710 | 4.33 | 157,117,828 | 4.44 | — 4.9 |
| Standard Oil Company (Kentucky) | 12,478,021 | 4.79 | 12,667,299 | 4.86 | — 1.5 |
| Standard Oil Company (New Jersey) | 808,534,919 | 4.11 | 709,309,992 | 3.60 | + 14.0 |
| Standard Oil Company (Ohio) | 26,591,560 | 5.35 | 23,008,465 | 4.77 | + 15.6 |
| Sun Oil Company | 56,160,053 | 5.22 | 48,307,360 | 4.49 | + 16.3 |
| Sunray Mid-Continent Oil Corporation | 45,309,643 | 2.40 | 39,471,783 | 2.28 | + 14.8 |
| Texam Oil Corporation | 8,620 | .... | **Loss 47,995** | .... | .... |
| The Texas Company | 302,262,620 | 5.51 | 262,729,738 | 4.79 | + 15.0 |
| Texas Gulf Producing Company | 5,657,708 | 1.46 | 6,320,029 | 1.63 | — 10.5 |
| Texas Pacific Coal & Oil Company | 7,209,694 | 2.01 | 7,949,373 | 2.21 | — 9.3 |
| Tidewater Oil Company | 37,990,000 | 2.90 | 37,790,000 | 2.89 | + 0.5 |
| TXL Oil Corporation | 3,716,422 | .67 | 2,991,361 | .54 | + 24.2 |
| Union Oil Company of California | 34,240,878 | 4.45 | 30,522,963 | 3.96 | + 12.2 |
| Union Oil & Gas Corporation of Louisiana | 3,315,748 | 1.83 | 3,093,120 | 1.71 | + 7.2 |
| United Gas Corporation | 29,387,842 | 2.28 | 26,155,913 | 2.03 | + 12.4 |
| Universal Consolidated Oil Company | 3,354,516 | 3.50 | 2,295,181 | 2.39 | + 46.2 |
| Venezuelan Petroleum Company | 9,152,237 | 2.28 | 5,038,613 | 1.25 | + 81.6 |
| Wilcox Oil Company | 783,082 | 2.75 | 981,994 | 3.45 | — 20.3 |
| Woodley Petroleum Company | 2,233,235 | 2.92 | 1,372,446 | 1.79 | + 62.7 |
| Zapata Petroleum Corporation | 411,514 | .38 | 428,621 | .40 | — 4.0 |
| * Total 74 Companies | 3,879,155,687 | .... | 3,453,229,522 | .... | + 12.3 |

* Creole, Humble, Imperial Oil and International Petroleum are excluded from totals, being included as subsidiaries of Standard Oil Company (New Jersey).

† Includes $5,907,313 property dividend in form of Mission Development Company stock.

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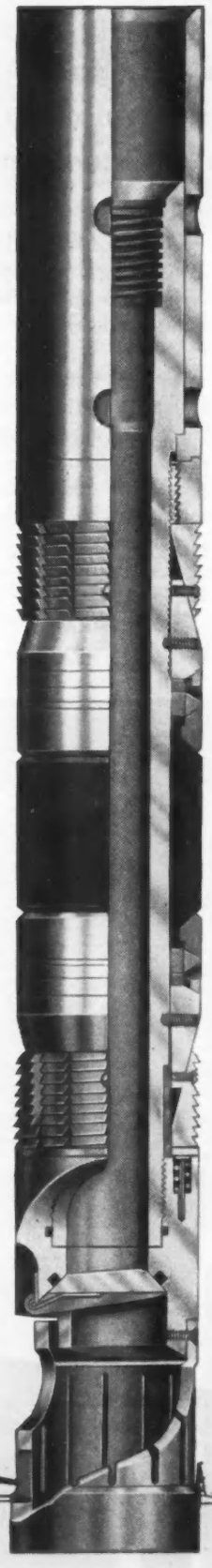

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**BAKER OIL TOOLS, INC.** HOUSTON • LOS ANGELES • NEW YORK

By **RAY L. DUDLEY,** Publisher, and **WARREN L. BAKER,** Editor

# U. S. Market Outlook Uncertain

**Crude markets in a very strong position, but imports and refining outputs need to be held to reasonable volumes in order to avoid serious problems.**

**Several questions** make the outlook for U. S. oil markets uncertain. The future depends on whether the industry tailors its operations to fit seasonal requirements and existing stock conditions during the next two months.

Crude markets are in very favorable condition. Stocks are low. Production allowables presage continued favorable conditions.

On the other hand, the threat of excessive refined product stocks still hangs over the industry. Inventories of both gasoline and distillate fuel are high. However, the situation is not acute and can be corrected if refining output is held to reasonable limits. But the situation could become serious if refining output is not tailored to fit needs.

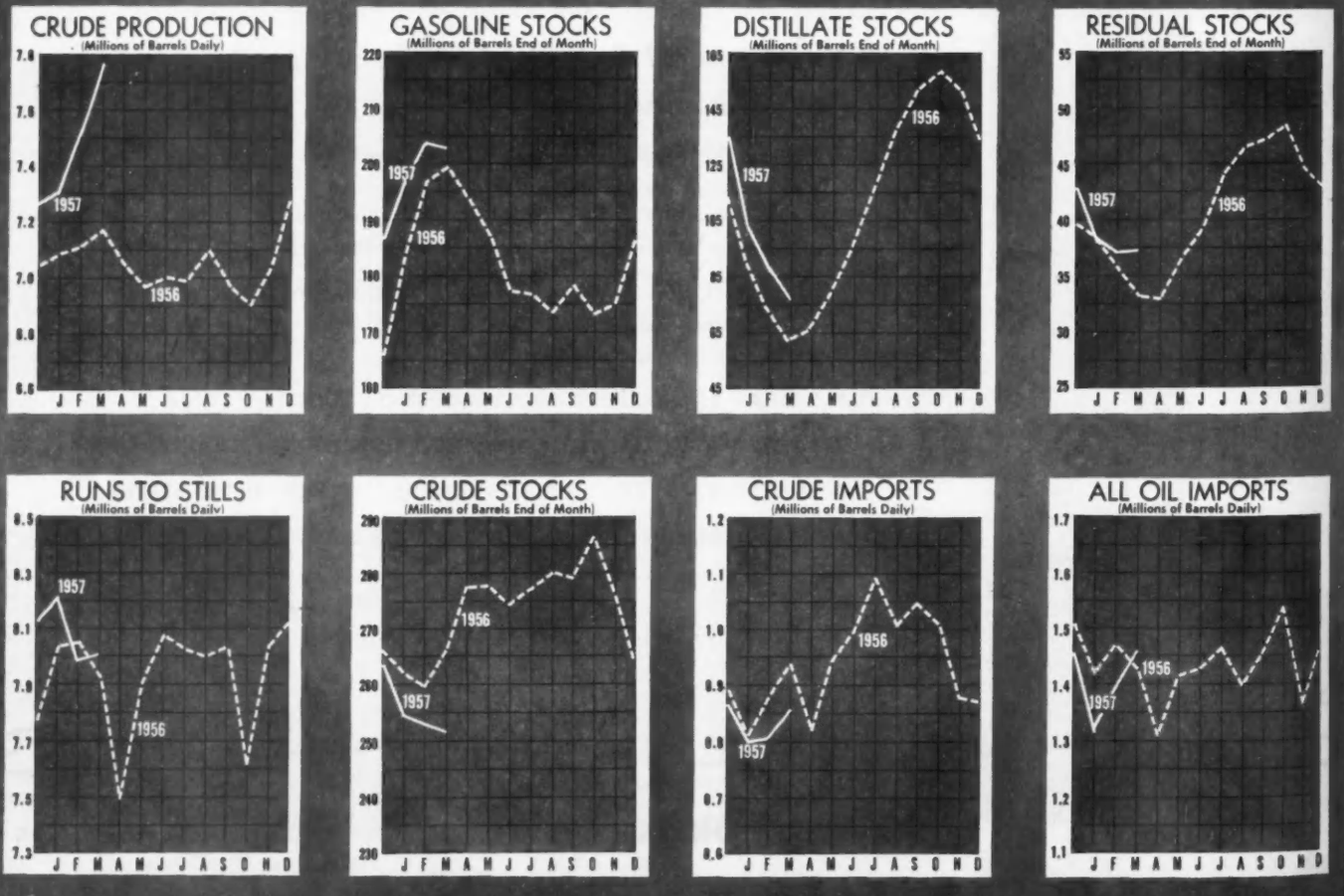
Imports are another uncertainty. Reopening of the Suez Canal poses a problem. If Middle East oil shipments return to levels that existed prior to Suez blockage, Venezuela shipments must be curtailed to avoid excessive U. S. imports.

The next two months will go a long way toward determining the character of U. S. markets for the next 12 months. Reasonable imports and U. S. refining output will put the industry in a strong market position, but excessive imports and refining activity would create serious problems.

**Crude markets** are in their strongest position in years due to heavy shipments to Europe during the Suez emergency. U. S. crude stocks currently total only 255 1/3 million barrels compared with 286½ million at the end of last October. At this level crude stocks are about the same as on January 1.

The crude market is further strengthened by prospects that U. S.

## *Petroleum Trends . . .*



producing rates are being carefully regulated to fit needs. Output in April was reduced and will be further curtailed in May. This is in line with the seasonal decline in oil consumption, and reduction in shipments to Europe.

These developments presage that the domestic crude oil market is to continue strong in the months ahead.

**Excessive stocks** of both gasoline and distillate exist at this moment. Further reductions in refining operations are needed to strengthen the U. S. product market. Refinery runs have been reduced in the last two months. However, they have not been reduced enough in view of the sharp decline in consuming rates. Consumption always slumps sharply in the second quarter. The decrease this year will be much larger than normal due to reduced shipments to Europe.

Gasoline stocks in mid-April totaled 203 million barrels, 8 million barrels greater than a year ago. Distillate fuel oil stocks totaled 74 million barrels, 13½ million above a year ago. Both gasoline and distillate supplies are on the high side.

However, proper regulation of refining output during the next two months would result in great improvement. This improvement can be achieved if crude runs are held to about 7,800,000 barrels daily during the last part of April and May, gasoline yields to slightly less than 3,700,000 barrels daily, and distillate fuel yields are limited to 1,750,000 barrels daily. These levels would not be far below levels during the first two weeks of April.

On the other hand, if refinery operations exceed the above levels, the threat of excessive gasoline and distillate stocks will become serious.

**Large-scale imports** have existed during the first quarter of 1957 despite blockage of the Suez Canal. Increased shipments from Venezuela have replaced curtailed movements from the Middle East.

Now that Middle East shipments are expected to resume normal levels, a flood of imports will result unless Venezuela deliveries are reduced. This would greatly damage both crude oil and refined product markets.

Consequently, the future of U. S. oil markets depends as much on activity abroad as it does on domestic operations.

## U. S. Crude Production by States

(THOUSANDS OF BARRELS)

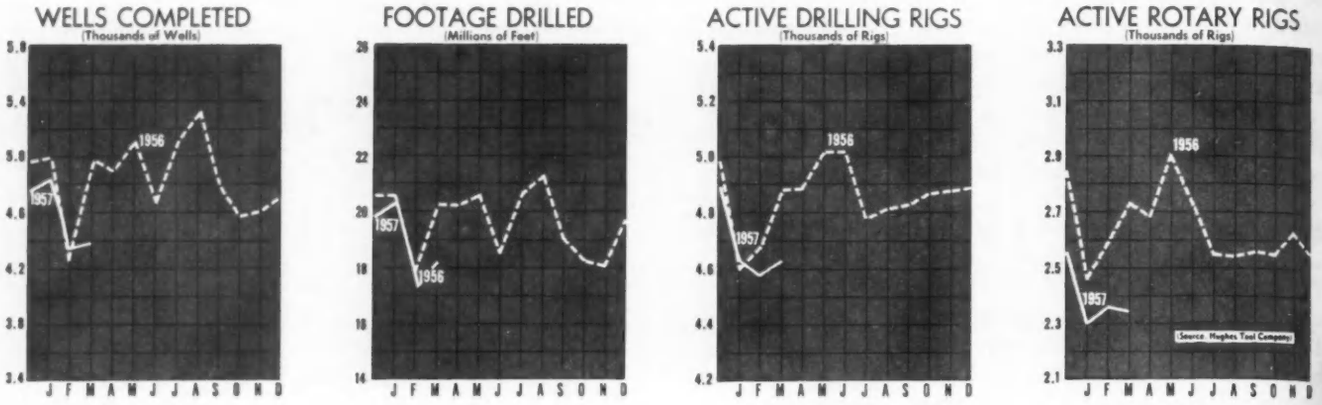
| STATE or DISTRICT | DAILY AVERAGE PRODUCTION | | | | TOTAL PRODUCTION FIRST THREE MONTHS | | |
|---|---|---|---|---|---|---|---|
| | March, 1957 | February, 1957 | March, 1956 | % Diff. 1957-1956 | 1957 | 1956 | % Diff. 1957-1956 |
| Alabama | 11.7 | 11.4 | 5.7 | +105.3 | 1,037 | 468 | +121.6 |
| Arkansas | 83.7 | 81.0 | 77.5 | + 8.0 | 7,471 | 6,986 | + 6.9 |
| California | 936.8 | 937.1 | 967.2 | — 3.2 | 84,380 | 88,222 | — 4.4 |
| Colorado | 158.5 | 158.7 | 159.8 | — 0.8 | 14,272 | 14,532 | — 1.8 |
| Florida | 1.3 | 1.2 | 1.4 | — 7.2 | 113 | 125 | — 9.6 |
| Illinois | 229.5 | 232.9 | 227.2 | + 1.0 | 20,645 | 20,467 | + 0.9 |
| Indiana | 32.4 | 32.2 | 28.4 | + 14.1 | 3,027 | 2,544 | + 19.0 |
| Kansas | 345.9 | 351.8 | 346.8 | — 0.3 | 30,914 | 31,051 | — 0.5 |
| Kentucky | 48.8 | 50.0 | 48.0 | + 1.7 | 4,352 | 4,358 | — 0.1 |
| Louisiana | 1,013.5 | 978.0 | 820.7 | + 23.5 | 89,707 | 73,432 | + 22.2 |
| North Louisiana | 132.5 | 130.0 | 131.8 | + 0.5 | 12,066 | 11,655 | + 3.5 |
| South Louisiana | 881.0 | 848.0 | 688.9 | + 27.9 | 77,641 | 61,777 | + 25.7 |
| Michigan | 27.6 | 27.2 | 29.5 | — 6.5 | 2,504 | 2,837 | — 11.7 |
| Mississippi | 114.2 | 112.8 | 113.8 | + 0.4 | 10,184 | 10,182 | ..... |
| Missouri | 0.1 | 0.2 | 0.1 | ..... | 15 | 15 | ..... |
| Montana | 72.2 | 72.2 | 57.6 | + 25.3 | 6,386 | 5,047 | + 26.5 |
| Nebraska | 38.3 | 38.4 | 43.4 | — 11.8 | 3,726 | 3,636 | + 2.5 |
| Nevada | 0.1 | 0.1 | 0.1 | ..... | 9 | 19 | — 52.6 |
| New Mexico | 268.1 | 257.9 | 244.0 | + 9.9 | 23,471 | 22,042 | + 6.5 |
| Southeast New Mexico | 265.5 | 254.9 | 240.0 | + 10.6 | 23,304 | 21,763 | + 7.1 |
| Northwest New Mexico | 2.6 | 3.0 | 4.0 | — 35.0 | 167 | 279 | — 40.2 |
| New York | 7.7 | 6.5 | 7.2 | + 6.9 | 639 | 677 | — 5.6 |
| North Dakota | 39.2 | 36.2 | 41.9 | — 6.5 | 3,526 | 3,709 | — 4.9 |
| Ohio | 13.8 | 13.4 | 12.2 | + 13.1 | 1,207 | 1,126 | + 7.2 |
| Oklahoma | 674.2 | 641.6 | 623.3 | + 8.2 | 57,894 | 56,150 | + 3.1 |
| Pennsylvania | 22.8 | 24.2 | 21.2 | + 7.5 | 2,080 | 1,988 | + 4.6 |
| South Dakota | 0.1 | 0.1 | 0.1 | ..... | 6 | 5 | + 20.0 |
| Tennessee | 0.1 | 0.1 | 0.1 | ..... | 4 | 4 | ..... |
| Texas | 3,324.4 | 3,131.0 | 3,101.7 | + 7.2 | 287,456 | 280,924 | + 2.3 |
| Dist. 1: South Central | 57.4 | 56.5 | 54.4 | + 5.5 | 5,097 | 4,744 | + 7.4 |
| Dist. 2: Middle Gulf | 172.2 | 161.0 | 159.6 | + 7.9 | 14,627 | 14,586 | + 0.3 |
| Dist. 3: Upper Gulf | 485.4 | 459.6 | 455.4 | + 6.6 | 42,164 | 41,725 | + 1.1 |
| Dist. 4: Lower Gulf | 258.9 | 244.6 | 252.4 | + 2.6 | 22,217 | 22,792 | — 2.5 |
| Dist. 5: East Central | 44.2 | 42.4 | 47.4 | — 6.8 | 3,795 | 4,275 | — 11.2 |
| Dist. 6: Northeast | 380.8 | 358.7 | 356.2 | + 6.9 | 32,486 | 32,512 | — 0.1 |
| Dist. 7-B: North Central | 172.7 | 165.1 | 162.6 | + 6.2 | 14,998 | 14,229 | + 5.4 |
| Dist. 7-C: West Central | 179.4 | 174.6 | 181.8 | — 1.3 | 15,771 | 16,331 | — 3.4 |
| Dist. 8: West | 1,251.2 | 1,157.4 | 1,051.7 | + 19.0 | 106,653 | 94,464 | + 12.9 |
| Dist. 9: North | 216.6 | 212.8 | 210.7 | + 2.8 | 19,163 | 18,694 | + 2.5 |
| Dist. 10: Panhandle | 105.6 | 98.3 | 94.2 | + 12.1 | 9,176 | 8,477 | + 8.2 |
| Utah | 12.9 | 11.8 | 4.6 | + 80.4 | 1,062 | 502 | + 11.6 |
| Virginia | 0.1 | 0.1 | 0.1 | ..... | 3 | 3 | ..... |
| West Virginia | 6.2 | 6.1 | 5.9 | + 5.1 | 542 | 540 | + 0.4 |
| Wyoming | 300.2 | 301.4 | 288.7 | + 4.0 | 27,006 | 26,221 | + 3.0 |
| Total United States | 7,784.4 | 7,515.6 | 7,278.2 | + 7.0 | 683,638 | 657,812 | + 3.9 |

## U. S. Crude Oil and Refined Product Trends

(THOUSANDS OF BARRELS)

| MONTH | CRUDE OIL | | | GASOLINE | | DISTILLATE FUEL | | RESIDUAL FUEL | | DAILY IMPORTS | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Production Daily | Runs to Stills Daily | Stocks End of Month | Production Daily | Stocks End of Month | Production Daily | Stocks End of Month | Production Daily | Stocks End of Month | Crude Oil | Total Oils |
| 1955: | | | | | | | | | | | |
| July | 6,632 | 7,580 | 264,601 | 3,824 | 157,079 | 1,575 | 119,169 | 1,091 | 44,894 | 860 | 1,161 |
| August | 6,665 | 7,580 | 256,427 | 3,858 | 151,912 | 1,621 | 133,675 | 1,090 | 45,480 | 756 | 1,155 |
| September | 6,731 | 7,483 | 256,269 | 3,784 | 150,194 | 1,621 | 143,248 | 1,061 | 46,267 | 829 | 1,218 |
| October | 6,831 | 7,465 | 267,346 | 3,827 | 153,103 | 1,612 | 152,288 | 1,123 | 47,040 | 821 | 1,206 |
| November | 7,014 | 7,692 | 260,707 | 3,867 | 157,871 | 1,680 | 141,808 | 1,214 | 44,071 | 823 | 1,322 |
| December | 7,155 | 7,762 | 265,610 | 3,916 | 165,433 | 1,765 | 111,333 | 1,286 | 39,174 | 884 | 1,502 |
| 1956: | | | | | | | | | | | |
| January | 7,199 | 8,023 | 261,592 | 3,927 | 183,905 | 1,923 | 86,141 | 1,344 | 38,247 | 805 | 1,422 |
| February | 7,208 | 8,047 | 259,504 | 3,854 | 196,092 | 1,918 | 71,335 | 1,286 | 35,673 | 878 | 1,472 |
| March | 7,278 | 7,914 | 265,683 | 3,829 | 199,698 | 1,808 | 60,846 | 1,213 | 32,984 | 934 | 1,425 |
| April | 7,146 | 7,487 | 277,121 | 3,646 | 193,299 | 1,713 | 63,571 | 1,130 | 32,740 | 815 | 1,305 |
| May | 7,064 | 7,896 | 277,497 | 3,859 | 186,673 | 1,667 | 75,928 | 1,149 | 36,607 | 938 | 1,416 |
| June | 7,100 | 8,071 | 274,491 | 3,976 | 177,076 | 1,755 | 93,758 | 1,098 | 39,073 | 987 | 1,426 |
| July | 7,090 | 8,014 | 277,008 | 3,975 | 176,536 | 1,767 | 115,787 | 1,066 | 43,958 | 1,084 | 1,463 |
| August | 7,195 | 7,995 | 279,944 | 4,037 | 172,939 | 1,839 | 137,905 | 1,091 | 46,617 | 1,001 | 1,399 |
| September | 7,054 | 8,024 | 278,791 | 3,991 | 177,974 | 1,845 | 150,411 | 1,062 | 47,342 | 1,043 | 1,452 |
| October | 6,966 | 7,608 | 286,560 | 3,773 | 172,798 | 1,772 | 158,871 | 1,082 | 48,400 | 1,004 | 1,541 |
| November | 7,139 | 8,031 | 275,995 | 3,913 | 174,808 | 1,841 | 151,517 | 1,182 | 44,590 | 871 | 1,362 |
| December | 7,377 | 8,141 | 266,014 | 4,039 | 187,271 | 1,981 | 133,981 | 1,288 | 44,491 | 873 | 1,471 |
| 1957: | | | | | | | | | | | |
| January | 7,480 | 8,274 | 256,669 | 3,991 | 197,702 | 2,118 | 100,572 | 1,322 | 38,403 | 805 | 1,421 |
| February | 7,516 | 7,992 | 253,093 | 3,789 | 203,749 | 2,029 | 85,698 | 1,243 | 37,068 | 809 | 1,396 |
| March | 7,784 | 8,042 | 252,313 | 3,704 | 203,412 | 1,856 | 75,615 | 1,219 | 37,311 | 860 | 1,457 |
| Week Ended: | | | | | | | | | | | |
| 4-12-57 | 7,441 | 7,899 | 255,316 | 3,760 | 202,904 | 1,779 | 74,156 | 1,118 | 36,758 | 1,047 | 1,385 |
| 4-13-56 | 7,156 | 7,551 | 267,085 | 3,631 | 195,059 | 1,739 | 60,832 | 1,168 | 32,788 | 886 | 1,302 |

## *Drilling Activities . . .*




# Year's Wells Trail 1956, But Future Looks Brighter

**By CECIL W. SMITH,** World Oil Staff

At the close of March there were some encouraging signs that the nation's drilling activity may be starting the long climb back to last year's rates. The number of drilling rigs at work had gained almost 1 percent during March, and later reports indicated continued growth. Several areas had recent discoveries of importance, and these are expected to bolster both wildcat and development work in those spots.

March's completed wells did not lend much encouragement. Although they topped the total completed during February, they did not measure up on a daily average basis. This month's failure to show much of an increase resulted in this year's first quarter's wells falling considerably behind last year's performance.

There is a great amount of optimism among industry observers who keep close check on the industry's drilling efforts. Most feel strongly that this "slump" is only temporary, and that by year's end the total program will have surpassed the 1956 top performance. This could well be the way it will turn out. It will be remembered that last year's record was reached despite the setbacks in the final four months caused by the steel strike-induced pipe shortages. This year it may be a case of turnabout.

There seems to be no one cause for the relatively quiet drilling scene. In fact, the factors that usually stimulate drilling are now present. Crude production is currently at all-time peaks and prices are higher. Many believe that additional crude price increases are justified and needed, but the fact remains that they are now higher than they were a year ago when drilling activity was setting a fast pace. Brad Mills, executive vice president of American Association of Oilwell Drilling Contractors, made a statement to the effect that excessive imports, governmental suspicion and interference toward the petroleum industry, nervousness in money and commodity markets, and shifting of available funds from domestic to costly offshore and foreign operations were largely responsible for the early 1957 decline in drilling activity. Mills added that only a serious break in the national economy could cause further decline, and that the nation's increasing consumption of oil was necessitating an expanded drilling program.

The number of active drilling rigs at the end of March totaled 4621, an increase of almost 1 percent over the 4582 counted a month earlier. Principal gains took place in Texas, Kansas and Mississippi. Rigs are reportedly moving into the hot Four Corners area of Colorado, Utah and New Mexico, where the current discovery rate is very high. Strong geophysical activity in southern Louisiana indicates that the near future will see stepped-up wildcat drilling.

**Summary of U. S. Drilling Activity**

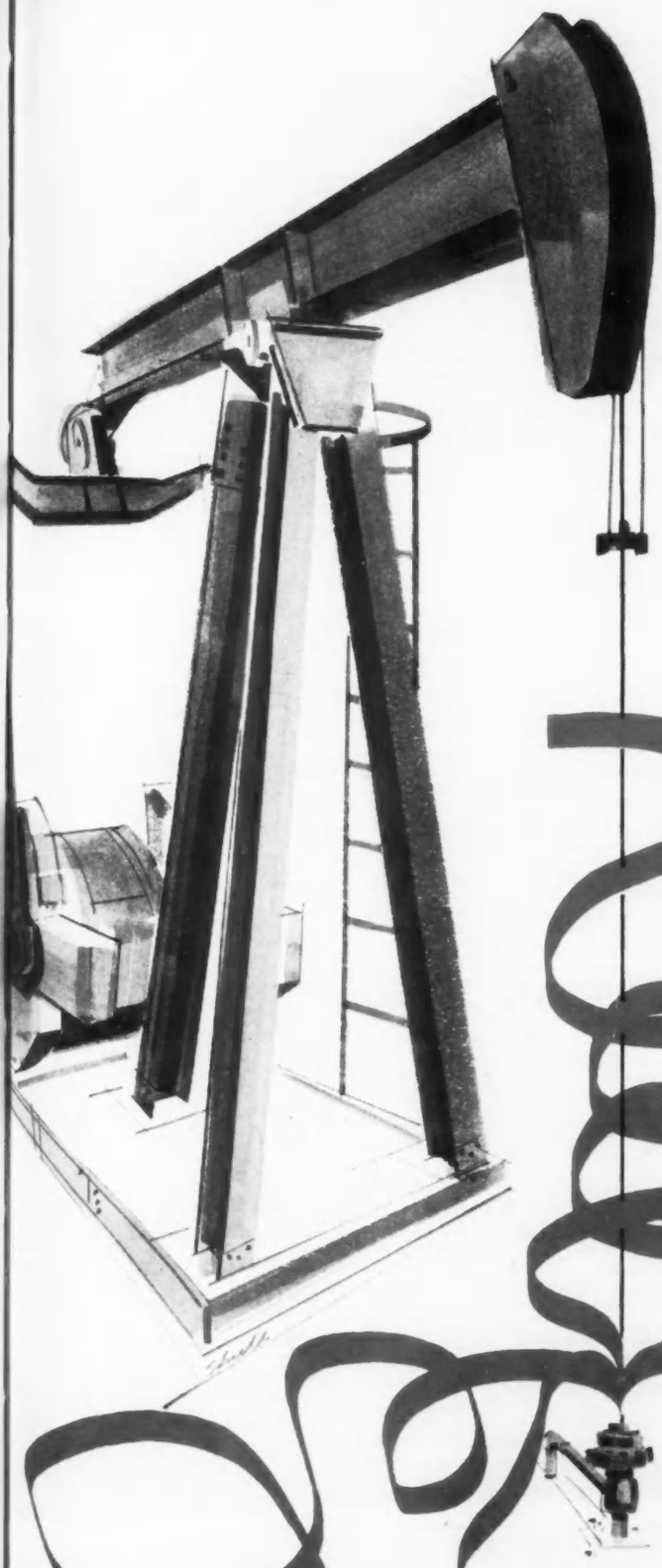
| ITEM | Mar., 1957 | Feb., 1957 | THREE MONTHS January-March 1957 | 1956 | Percent Diff. |
|---|---|---|---|---|---|
| **New Wells Completed:** | | | | | |
| Oil | 2,303 | 2,361 | 7,294 | 7,644 | — 4.6 |
| Dist. | 61 | 40 | 154 | 149 | + 3.4 |
| Gas | 314 | 280 | 895 | 960 | — 6.8 |
| Service | 72 | 81 | 234 | 217 | + 7.8 |
| Dry | 1,627 | 1,500 | 4,911 | 5,184 | — 5.3 |
| **Total Wells** | 4,377 | 4,262 | 13,488 | 14,154 | — 4.7 |
| **Footage Drilled (Mln. of Feet)** | 18.1 | 17.3 | 55.9 | 58.4 | — 4.3 |

*Details on Page 114*

**Summary of U. S. Wildcat Drilling**

| ITEM | Mar., 1957 | Feb., 1957 | THREE MONTHS January-March 1957 | 1956 | Percent Diff. |
|---|---|---|---|---|---|
| **New Field Discoveries:** | | | | | |
| Oil | 55 | 63 | 216 | 251 | —14.0 |
| Distillate | 11 | 9 | 35 | 29 | +20.7 |
| Gas | 15 | 22 | 56 | 47 | +19.1 |
| **Total Discoveries** | 81 | 94 | 307 | 327 | — 6.1 |
| Dry Wildcats | 827 | 760 | 2,533 | 2,566 | — 1.3 |
| **Total Wildcats** | 908 | 854 | 2,840 | 2,893 | — 1.8 |
| Percent Productive | 8.9 | 11.0 | 10.8 | 11.3 | ..... |
| Percent Dry | 91.1 | 89.0 | 89.2 | 88.7 | ..... |

*Details on Page 114*



# are you pumping red tape?

If you are there's no quick, easy solution to your problem. But an answer must be found. The red tape of oil operation can choke production as surely as a well that is sanding up. These higher operation costs can cut your profit to the point that you are working only for your creditors.

Although you have no control over your sales price, you can control your costs. Working with your legal and tax counsel, The Commerce can analyze your costs, find where economies can be effected, thereby increasing the profitableness of your operation by helping you to cut your costs. Your income goes up when you stop pumping red tape.

*Facilities of The National Bank of Commerce Oil Loan Department are available in Wyoming, Nebraska, Colorado, New Mexico, Texas, Louisiana, and Mississippi.*

**E. O. Buck, vice president, Oil Loan Department**

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

**THE NATIONAL BANK OF**

# COMMERCE

**OF HOUSTON**

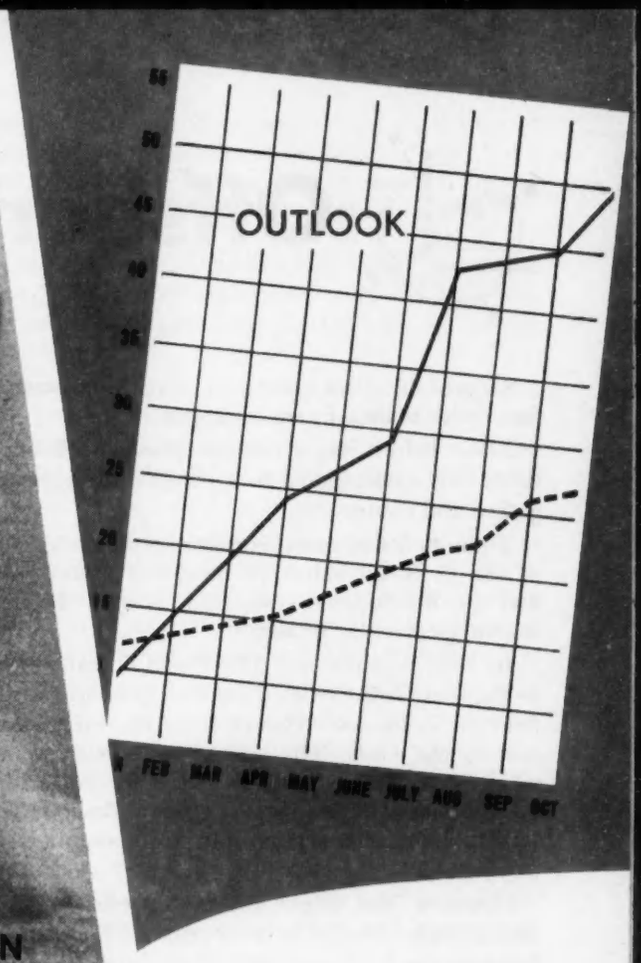
*Gulf Building, Houston, Texas*

# U. S. Drilling Activity in March and First Three Months, 1957-1956

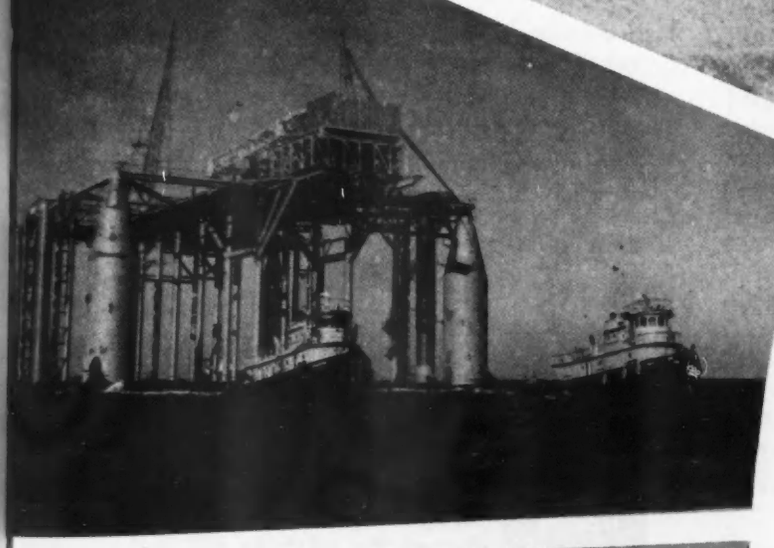
| STATE or DISTRICT | TOTAL NEW WELLS COMPLETED AND FOOTAGE DRILLED: DETAILS FOR MARCH, 1957 — Oil | Dist. | Gas | Dry | Service Wells | TOTAL NEW WELLS — Mar., 1957 | Feb., 1957 | Mar., 1956 | Total Footage March, 1957 | DETAILS FOR JANUARY-MARCH: NEW WELLS — 1957 | 1956 | Percent Diff. | FOOTAGE — 1957 | 1956 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Alabama | 9 | .... | 1 | 3 | .... | 13 | 15 | 5 | 125,364 | 30 | 17 | + 76.5 | 258,287 | 138,415 |
| Arizona | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | ..... | .... | .... |
| Arkansas | 47 | .... | 1 | 23 | .... | 71 | 67 | 78 | 190,215 | 253 | 195 | + 29.7 | 690,404 | 616,683 |
| California | 128 | .... | 7 | 45 | 1 | 181 | 143 | 178 | 810,993 | 533 | 549 | — 2.9 | 2,416,987 | 2,581,692 |
| Colorado | 12 | .... | 7 | 42 | .... | 61 | 74 | 106 | 299,127 | 221 | 340 | — 35.0 | 1,134,404 | 1,825,820 |
| Florida | .... | .... | .... | 3 | .... | 3 | 1 | 1 | 17,152 | 5 | 6 | — 16.7 | 33,392 | 35,002 |
| Georgia | .... | .... | .... | .... | .... | .... | 1 | .... | .... | 1 | ..... | ..... | 7,425 | .... |
| Idaho | .... | .... | .... | .... | .... | .... | .... | 1 | .... | 1 | 1 | ..... | 3,947 | 4,528 |
| Illinois | 65 | .... | 1 | 122 | .... | 188 | 166 | 237 | 432,599 | 570 | 745 | — 23.5 | 1,298,000 | 1,753,015 |
| Indiana | 12 | .... | 1 | 30 | .... | 43 | 39 | 45 | 62,353 | 154 | 138 | + 11.6 | 239,745 | 235,350 |
| Kansas | 138 | .... | 32 | 157 | 7 | 334 | 365 | 386 | 1,191,096 | 1,057 | 1,090 | — 3.0 | 3,755,849 | 3,969,191 |
| Kentucky | 44 | .... | 16 | 54 | 2 | 116 | 87 | 136 | 180,239 | 320 | 418 | — 23.5 | 516,027 | 588,718 |
| Louisiana | 141 | 18 | 16 | 110 | .... | 285 | 269 | 314 | 2,402,059 | 845 | 838 | + 0.8 | 7,222,761 | 6,596,079 |
| North Louisiana | 48 | .... | 5 | 29 | .... | 82 | 97 | 116 | 302,825 | 319 | 278 | + 14.7 | 1,152,106 | 1,060,760 |
| South Louisiana | 93 | 18 | 11 | 81 | .... | 203 | 172 | 198 | 2,099,234 | 526 | 560 | — 6.1 | 6,070,655 | 5,535,319 |
| * Gulf of Mexico | 32 | 6 | 2 | 19 | .... | 59 | 54 | 44 | 571,806 | 152 | 115 | + 32.2 | 1,449,863 | 1,064,559 |
| Maryland | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | ..... | .... | .... |
| Michigan | 9 | .... | .... | 24 | .... | 33 | 28 | 41 | 94,383 | 96 | 132 | — 27.3 | 293,640 | 368,506 |
| Mississippi | 11 | 1 | 1 | 18 | .... | 31 | 30 | 32 | 202,635 | 88 | 105 | — 16.2 | 611,528 | 774,458 |
| Missouri | .... | .... | .... | .... | .... | .... | .... | 13 | .... | .... | 14 | —100.0 | .... | 12,595 |
| Montana | 13 | .... | 1 | 10 | .... | 24 | 12 | 29 | 148,642 | 73 | 105 | — 30.5 | 429,680 | 539,247 |
| Nebraska | 22 | .... | .... | 43 | .... | 65 | 49 | 80 | 389,273 | 199 | 241 | — 17.4 | 1,187,688 | 1,350,490 |
| Nevada | .... | .... | .... | .... | .... | .... | .... | .... | .... | 1 | 1 | ..... | 3,386 | 7,885 |
| New Mexico | 94 | .... | 33 | 31 | .... | 158 | 195 | 142 | 706,826 | 574 | 439 | + 30.8 | 2,570,016 | 2,084,331 |
| New York | 20 | .... | 3 | 3 | 13 | 39 | 42 | 32 | 66,400 | 114 | 81 | + 40.7 | 194,900 | 116,600 |
| North Dakota | 12 | .... | .... | 10 | .... | 22 | 25 | 21 | 152,340 | 73 | 69 | + 5.8 | 491,345 | 543,278 |
| Ohio | 44 | .... | 12 | 20 | .... | 76 | 78 | 73 | 206,135 | 229 | 252 | — 9.1 | 570,786 | 616,051 |
| Oklahoma | 294 | 5 | 27 | 168 | 5 | 499 | 522 | 728 | 1,813,556 | 1,630 | 2,100 | — 22.4 | 5,692,035 | 7,592,749 |
| Oregon | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 1 | —100.0 | .... | 12,880 |
| Pennsylvania | 23 | .... | 23 | 9 | 23 | 78 | 69 | 72 | 234,993 | 221 | 192 | + 15.1 | 629,874 | 544,196 |
| South Dakota | .... | .... | .... | 5 | .... | 5 | 4 | .... | 21,034 | 11 | 1 | +1000.0 | 46,348 | 9,361 |
| Texas | 1,125 | 37 | 83 | 661 | 21 | 1,927 | 1,874 | 2,003 | 7,922,248 | 5,842 | 5,611 | + 4.1 | 24,298,332 | 23,564,567 |
| Dist. 1: South Central | 82 | 3 | 3 | 56 | .... | 144 | 101 | 186 | 380,454 | 383 | 505 | — 24.2 | 1,013,203 | 1,327,302 |
| Dist. 2: Middle Gulf | 17 | 8 | 9 | 24 | .... | 58 | 56 | 74 | 378,775 | 181 | 221 | — 18.1 | 1,164,314 | 1,368,019 |
| Dist. 3: Upper Gulf | 60 | 11 | 11 | 56 | .... | 138 | 134 | 167 | 962,274 | 451 | 439 | + 2.7 | 3,130,070 | 2,895,820 |
| * Gulf of Mexico | .... | .... | .... | .... | .... | .... | .... | 1 | .... | 4 | 4 | ..... | 31,433 | 40,088 |
| Dist. 4: Lower Gulf-S.W. | 40 | 7 | 12 | 62 | .... | 121 | 97 | 115 | 632,310 | 344 | 347 | — 0.9 | 1,797,522 | 1,839,409 |
| * Gulf of Mexico | .... | .... | .... | 2 | .... | 2 | 2 | .... | 22,512 | 5 | 3 | + 66.6 | 50,083 | 31,176 |
| Dist. 5: East Central | 2 | 1 | .... | 20 | .... | 23 | 13 | 25 | 93,161 | 52 | 67 | — 22.4 | 254,507 | 225,714 |
| Dist. 6: Northeast | 55 | 4 | 7 | 36 | .... | 102 | 85 | 60 | 547,409 | 291 | 210 | + 38.6 | 1,592,225 | 1,114,603 |
| Dist. 7-B: North Central | 110 | .... | 5 | 119 | .... | 234 | 200 | 273 | 788,230 | 695 | 840 | — 17.3 | 2,323,734 | 2,838,392 |
| Dist. 7-C: West Central | 49 | .... | 2 | 33 | .... | 84 | 136 | 127 | 340,044 | 342 | 323 | + 5.9 | 1,524,701 | 1,522,325 |
| Dist. 8: West | 364 | .... | 9 | 50 | 4 | 427 | 487 | 390 | 2,073,963 | 1,301 | 1,003 | + 29.7 | 6,377,077 | 5,069,437 |
| Dist. 9: North | 251 | 1 | 5 | 190 | 17 | 464 | 465 | 484 | 1,210,047 | 1,436 | 1,345 | + 6.8 | 3,675,534 | 4,213,819 |
| Dist. 10: Panhandle | 95 | 2 | 20 | 15 | .... | 132 | 100 | 102 | 515,581 | 366 | 311 | + 17.7 | 1,445,445 | 1,149,727 |
| Utah | 7 | .... | 1 | 13 | .... | 21 | 7 | 8 | 131,117 | 37 | 37 | ..... | 224,955 | 171,495 |
| Washington | .... | .... | .... | 1 | .... | 1 | .... | .... | 5,980 | 1 | 1 | ..... | 5,980 | 7,493 |
| West Virginia | 7 | .... | 46 | 4 | .... | 57 | 37 | 67 | 141,406 | 147 | 194 | — 24.2 | 403,047 | 522,552 |
| Wyoming | 26 | .... | 2 | 18 | .... | 46 | 63 | 71 | 199,077 | 162 | 241 | — 32.8 | 699,390 | 1,179,447 |
| Total United States | 2,303 | 61 | 314 | 1,627 | 72 | 4,377 | 4,262 | 4,899 | 18,147,242 | 13,488 | 14,154 | — 4.7 | 55,930,158 | 58,362,674 |
| Total Western Canada | 116 | .... | 4 | 62 | .... | 182 | 249 | 185 | 837,118 | 655 | 640 | + 2.3 | 2,994,365 | 3,031,779 |

| WILDCAT DRILLING IN MARCH AND FIRST THREE MONTHS, 1957-1956: DETAILS FOR MARCH, 1957 — Oil | Dist. | Gas | Dry | Total Wildcats | DETAILS FOR JANUARY-MARCH — Oil | Dist. | Gas | Dry | TOTAL WILDCATS — 1957 | 1956 | DRILLING RIGS IN OPERATION — Mar. 31, 1957 | Feb. 28, 1957 | Mar. 31, 1956 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| .... | .... | 1 | 3 | 4 | .... | .... | 1 | 10 | 11 | 6 | 15 | 24 | 15 |
| .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 1 | 1 | .... |
| .... | .... | .... | 12 | 12 | 1 | .... | .... | 29 | 30 | 31 | 69 | 67 | 52 |
| 1 | .... | 1 | 25 | 27 | 4 | .... | 2 | 84 | 90 | 63 | 176 | 179 | 223 |
| 2 | .... | 1 | 34 | 37 | 4 | .... | 3 | 126 | 133 | 159 | 50 | 46 | 69 |
| .... | .... | .... | 3 | 3 | .... | .... | .... | 5 | 5 | 6 | 1 | 1 | .... |
| .... | .... | .... | .... | .... | .... | .... | .... | 1 | 1 | .... | 2 | .... | 2 |
| .... | .... | .... | .... | .... | .... | .... | .... | 1 | 1 | 1 | .... | 1 | 1 |
| .... | .... | .... | 63 | 63 | 5 | .... | 1 | 159 | 165 | 176 | 207 | 254 | 240 |
| .... | .... | .... | 18 | 18 | 1 | .... | .... | 47 | 48 | 39 | 100 | 102 | 75 |
| 7 | .... | .... | 79 | 86 | 29 | .... | 7 | 198 | 234 | 271 | 496 | 480 | 449 |
| .... | .... | .... | 4 | 4 | 3 | .... | .... | 9 | 12 | 32 | 111 | 103 | 126 |
| 4 | 4 | 1 | 39 | 48 | 10 | 14 | 4 | 116 | 144 | 131 | 420 | 423 | 430 |
| .... | .... | .... | 8 | 8 | 1 | 1 | .... | 34 | 36 | 34 | 72 | 77 | 86 |
| 4 | 4 | 1 | 31 | 40 | 9 | 13 | 4 | 82 | 108 | 97 | 348 | 346 | 344 |
| 1 | .... | 1 | 6 | 8 | 4 | 4 | 1 | 14 | 23 | 17 | 96 | 94 | 75 |
| .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 2 |
| 1 | .... | .... | 16 | 17 | 4 | .... | .... | 40 | 44 | 43 | 65 | 62 | 62 |
| .... | .... | .... | 12 | 12 | 4 | .... | .... | 36 | 40 | 44 | 39 | 28 | 32 |
| .... | .... | .... | .... | .... | .... | .... | .... | 1 | 1 | 9 | .... | .... | .... |
| .... | .... | 1 | 6 | 7 | 1 | .... | 1 | 20 | 22 | 36 | 37 | 38 | 38 |
| .... | .... | .... | 26 | 31 | 11 | .... | .... | 90 | 101 | 121 | 36 | 37 | 48 |
| .... | .... | .... | .... | .... | .... | .... | .... | 1 | 1 | .... | 2 | 3 | 4 |
| .... | .... | .... | 18 | 22 | 13 | .... | 2 | 68 | 83 | 49 | 150 | 155 | 188 |
| .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 52 | 50 | 50 |
| .... | .... | .... | 8 | 8 | 2 | .... | .... | 28 | 39 | 20 | 22 | 22 | 22 |
| .... | .... | .... | .... | .... | .... | .... | .... | 3 | 3 | 1 | 208 | 228 | 218 |
| 4 | 2 | 1 | 52 | 59 | 18 | 4 | 6 | 154 | 182 | 221 | 575 | 577 | 656 |
| .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 1 | .... | .... | .... |
| .... | .... | 2 | 3 | 5 | .... | .... | 8 | 6 | 14 | .... | 165 | 156 | 143 |
| .... | .... | .... | 5 | 5 | .... | .... | .... | 11 | 11 | 1 | 3 | 6 | 1 |
| 25 | 5 | 7 | 374 | 411 | 99 | 17 | 16 | 1,223 | 1,355 | 1,325 | 1,338 | 1,261 | 1,473 |
| 2 | 1 | .... | 41 | 44 | 6 | 1 | .... | 108 | 115 | 146 | 51 | 48 | 77 |
| .... | 1 | 1 | 14 | 16 | .... | 3 | 5 | 50 | 58 | 59 | 43 | 39 | 51 |
| .... | 1 | .... | 32 | 33 | 6 | 5 | 1 | 113 | 125 | 120 | 136 | 133 | 165 |
| .... | .... | .... | .... | .... | 1 | .... | .... | 2 | 3 | 2 | 1 | 1 | 1 |
| 6 | 2 | 1 | 101 | 110 | 108 | 85 | 68 | 73 | | | | | |
| .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 1 | 3 | 4 | 2 |
| 1 | 1 | .... | 16 | 16 | .... | .... | .... | 35 | 37 | 34 | 5 | 7 | 7 |
| 1 | .... | 2 | 24 | 26 | 1 | .... | 2 | 66 | 69 | 63 | 71 | 72 | 67 |
| 28 | .... | 2 | 69 | 79 | 9 | .... | 2 | 209 | 239 | 312 | 128 | 117 | 171 |
| 12 | .... | 2 | 26 | 30 | 3 | .... | 2 | 91 | 105 | 73 | 95 | 90 | 124 |
| 16 | .... | 2 | 27 | 31 | 3 | .... | 2 | 109 | 127 | 131 | 378 | 326 | 362 |
| 18 | .... | .... | 84 | 90 | 6 | .... | .... | 320 | 338 | 251 | 232 | 238 | 269 |
| 5 | 5 | 1 | 21 | 32 | 2 | 2 | .... | 7 | 11 | 28 | 114 | 123 | 107 |
| 3 | .... | .... | 13 | 15 | 2 | .... | .... | 18 | 21 | 31 | 36 | 36 | 21 |
| .... | .... | .... | 1 | 1 | .... | .... | .... | 1 | 1 | 1 | .... | .... | .... |
| .... | .... | 4 | 2 | 6 | .... | .... | .... | .... | .... | .... | 180 | 177 | 175 |
| 4 | .... | 1 | 46 | 51 | 75 | 65 | 65 | 68 | | | | | |
| 55 | 11 | 15 | 827 | 908 | 216 | 35 | 56 | 2,533 | 2,840 | 2,893 | 4,621 | 4,582 | 4,883 |
| .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 223 | 232 | 173 |

* Gulf of Mexico wells are included in their respective district totals.




DRILLING

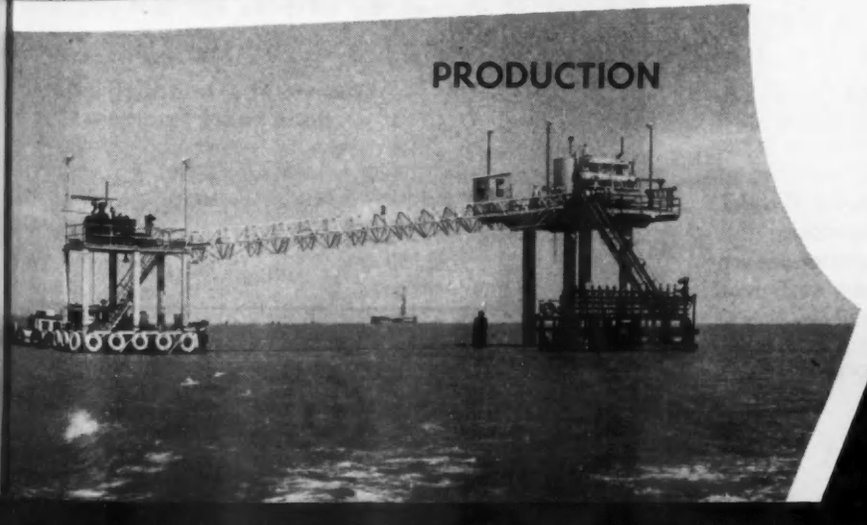


# Special OFFSHORE REPORT

Never before has a venture accomplished so much so fast against such terrific odds. Despite the tremendous weather hazards and expense, plus the retarding effect of government interference, the U. S. offshore oil domain has expanded to surprising proportions.

Oil men now know the offshore oil potential is vast, and they have the ability to find and produce it. Result: Future growth will be even more rapid than in the past.

This special report covers the past, present and future of offshore activities.



# Offshore Picture . . . *Activity reaches*

SELDOM, IF EVER, has a venture progressed so far so fast—with so little financial return.

Never before has a venture started to boom so many times only to be slowed to a standstill by government litigation and controversy.

These two statements summarize the spasmodic growth of the U. S. oil industry's sprawling infant—offshore oil and gas development—which is now in the midst of its fourth spectacular phase:

In 1938 Superior and The Pure Oil companies brought in the first Gulf Coast offshore oil producer in the Creole field off Louisiana's Cameron Parish—more than a mile out in the Gulf. The second milestone came in 1947 when Kerr-McGee, Phillips and Stanolind made the first substantial offshore discovery ten miles off Terrebonne Parish, Louisiana, opening up vast potentials for future development.

However, the bright future for offshore growth was immediately clouded by a six-year (1947-1953) legal fight between the U. S. and state governments over ownership of state lands. The third phase of growth started in 1953 after the signing of the Submerged Lands Act, recognizing rights of the states to the submerged lands within their traditional borders. Subsequently, exploration and drilling increased and steadily expanded, though still hindered by various forms of government hassels.

The 18-month-old fourth phase, actually an accelerated extension of the third, is again torn between two opposing factors—those that encourage progress and those that are holding it back.

**Pro-Progress:**

1. *Recent price increases.* The new crude price levels have given offshore operators new incentive to sink huge investments in expansion programs.

2. *Unusually high discovery rate.* In 1956, at least 26 percent of the offshore wildcats were producers, compared with the U. S. average of 11 percent.

3. *Dollar return on investment.* Tremendous capital outlays have placed increasing importance on offsetting income.

4. *Committed investment.* The money already spent on leases, equipment and other facilities precludes any lengthy deferment of drilling programs.

5. *Sufficient development of gas fields to obtain Federal Power Commission approval for pipe lines.* Since the only way to market gas is by pipe lines, it is necessary under government regulation to prove sufficient volume to warrant construction of a line.

6. *Threats to Middle East supplies.* This recent development has heightened interest in Western Hemisphere drilling activity.

**Anti-Progress:**

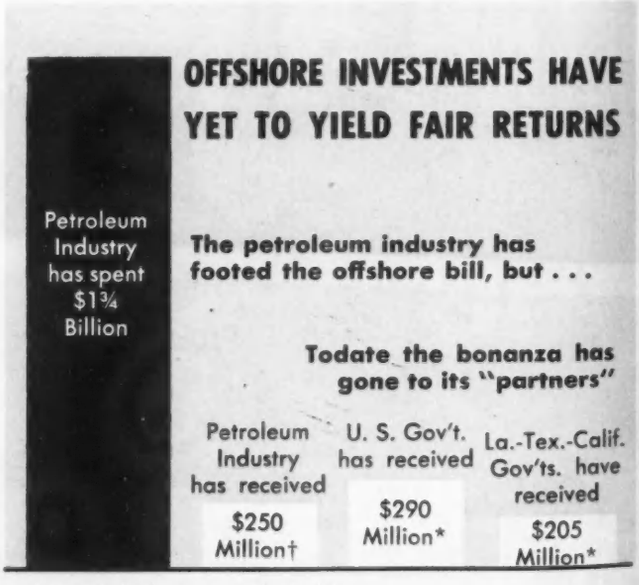
1. *Renewed government litigation.* In recent months, the future has again been clouded. Louisiana claims its boundary as 10½ miles from shore, the same as Texas and Florida. This is in contrast with the three-mile limit for all other states. The method of setting the boundary, no matter what the distance, will present serious problems before settlement is reached.

   The immediate outlook for California offshore activity has been muddied by the recent action of the state legislature in halting any further granting of leases until it has reviewed the royalty scale, currently 12½ percent plus bonus on wildcat acreage and 16⅔ plus bonus for so-called proven ground over a known structure. Certain members of the legislature are demanding that a sliding scale royalty, with the lowest being 12½ percent, be applied to wildcat leases.

   Whatever the outcome, this legislative action has the effect of halting all further granting of leases for about one year.

2. *Reduction in offshore allowables* resulting from world supplies exceeding needs. Tied in with this are unnecessarily high U. S. imports.

3. *Material shortages.* Shortages of steel structurals and plates as well as fabricating facilities for certain equipment have retarded the over-all program.


OFFSHORE INVESTMENTS HAVE YET TO YIELD FAIR RETURNS
Petroleum Industry has spent $1¾ Billion
The petroleum industry has footed the offshore bill, but . . .
To date the bonanza has gone to its "partners"
Petroleum Industry has received
$250 Million†
U. S. Gov't. has received
$290 Million*
La.-Tex.-Calif. Gov'ts. have received
$205 Million*

* Lease rentals, bonuses, and royalties.

† Income from oil & gas production.

## peak . . . more growth in sight

4. *Tight money.* Financing costs have risen steadily with the shortage of money.

**Future Very Bright.** Despite these deterrent factors oil leaders are firmly convinced offshore developments will progress rapidly. Predictions are that within the next few years:

- Prodution will be five times greater than early 1957 rate of 150,000 bpd—probably within ten years.
- Within a shorter period of time, an average of 1000 wells a year will be drilled, compared with an expected 700 wells in 1957.
- At least 300 drilling structures will be in service off Louisiana and Texas, compared with 127 in 1957.
- Radical new exploration, drilling and production techniques will be developed as the search for oil moves farther from shore into hundreds of feet of water.

The foundation for these predictions is the offshore situation as it stands today. Here is a review of what has happened to date, plus a close look at the future:

**Offshore Rigs.** As late as 1954, only 30 drilling units were active along the Texas and Louisiana coasts. In 1955, an average of 52 units were in operation. Last year, the total rose to more than 100, with 127 slated for use in 1957—four times as many as were in operation only three years earlier.

At present, available drilling units can handle anticipated drilling programs through 1957, although there could be an occasional shortage due to high activity in some areas.

The following table shows the rig count by areas, and types of wells being drilled.

Today's drilling units were designed for water depths of 125 feet or less. As the search broadens and moves outward to the edge of the Continental Shelf to depths of 600 feet, new units will have to be designed and built. By the time this happens, it is not unlikely that 300 drilling structures will be in service off Louisiana and Texas.

| AREA | Wildcat | Field Development | Total |
|---|---|---|---|
| LOUISIANA: | | | |
| Bay Marchand | .. | 9 | 9 |
| Breton Sound | .. | 1 | 1 |
| East Cameron | 2 | 5 | 7 |
| West Cameron | 3 | 3 | 6 |
| Eugene Island | 1 | 17 | 18 |
| Grand Isle | .. | 8 | 8 |
| Main Pass | .. | 6 | 6 |
| Ship Shoal | .. | 5 | 5 |
| South Pass | 3 | 8 | 11 |
| South Timbalier | 1 | 4 | 5 |
| Vermilion | 3 | 1 | 4 |
| West Delta | 3 | 13 | 16 |
| Total Louisiana | 16 | 80 | 96 |
| TEXAS: | | | |
| RRC Dist. 3 | .. | 1 | 1 |
| RRC Dist. 4 | 1 | 3 | 4 |
| Total Texas | 1 | 4 | 5 |
| CALIFORNIA: | | | |
| Seal Beach | .. | 1 | 1 |
| Total Offshore (4-1-57) | 17 | 85 | 102 |

**Wells Drilled.** Due to the vast scope of leasing operations offshore, wells drilled for exploratory purposes have predominated to date with an exceptionally high percentage of successes to failures.

Several factors will cause increased future drilling. The necessity of proving up existing leases will lead to greater exploratory activity. Exploratory operations also will be encouraged by the high ratio of success being experienced offshore.

At the same time the necessity of starting to show a profit will force offshore operators into more intensive development drilling. While to date much of the offshore drilling has been of an exploratory nature, an increasing portion in the future will be development drilling.

Some of the offshore leases will expire within the next two years, but the majority will expire in 1960. The greatest concentration of development work is in the Eugene Island, South pass and West Delta areas of Louisiana.

Since offshore drilling is mostly in 5000-acre blocks, with operators sometimes holding the adjoining blocks, protection drilling has not been necessary in the past. Field designations have been assigned on a one-well basis. But now these blocks must be developed and leases must be either confirmed or condemned.

Last year, 446 wells were completed offshore of Louisiana, 33 off the Texas coast, and 8 off California for a total of 487 offshore wells. Discoveries and percentage of success off Texas have not been too encouraging to date—and California has just barely entered the offshore picture.

Last year's 487-well total was 23 percent better than the 396 drilled in 1955. Despite the crippling effect of government litigation, this was by far the greatest offshore drilling effort in a single year. About 700 wells will be drilled this year, and 1000 wells a year in the very near future.

Since drilling rigs first went into the open waters of the Gulf of Mexico, 1530 wells have been drilled, and about 1200 of these were drilled since 1954. More than 1400 of the total have been drilled in Louisiana waters.

Some idea of the gigantic task ahead in developing the Gulf of Mexico offshore domain may be obtained from onshore experience. The land portion of the Continental shelf consists of 40,000 square miles, extending inland almost 100 miles at points. An equivalent area in the Gulf would stretch from the shoreline to a depth of about 160 feet, and would have a maximum width of almost 100 miles at Texas' and Louisiana's common border.

The 600-odd producing structures within the onshore area required the drilling of about 80,000 wells. Much of the shelf that is covered with water is proving geologically to be more of the same that has been so productive onshore.

If this water-covered belt proves to be a seaward extension of the onshore province, it can readily be seen that many thousands of tests must yet be drilled. Of course, a like number of structures offshore would not require as many wells as have those on land. The reasons are obvious: Onshore operations have been in existence

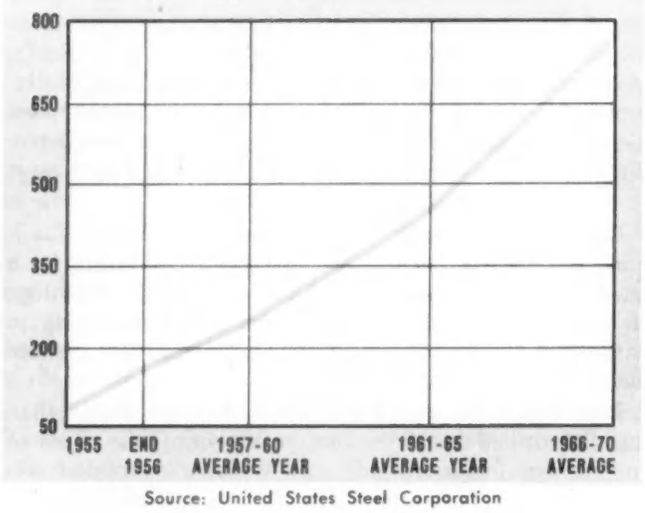
since Spindletop and Jennings discoveries in 1901. Many wildcats were located and drilled without the benefit of geophysics or many of the other modern tools that have and will be used in offshore development.

**Offshore Production.** Although offshore production is climbing at a spectacular pace, the break-even point is apparently far down the road.

Oil companies have poured tremendous amounts of money, time, manpower and equipment into these operations. Still they are considerably "in the red." Income to date from sale of offshore oil and gas totals approximately $250 million, compared with an over-all investment of about $1.7 billion.

**OFFSHORE CRUDE PRODUCTION IS EXPECTED TO SHOW RAPID INCREASE**

(Thousands of Barrels Daily)




Source: United States Steel Corporation

Although production from the entire Continental Shelf now is averaging about 150,000 barrels of crude and condensate, and 360 million cubic feet of gas daily, even today the industry is plowing back about twice as many dollars as it is taking out.

Bulk of the offshore oil and gas production is coming from the Louisiana fields. Texas' and California's combined oil production is currently averaging only about 2000 barrels a day.

Total take from the Continental Shelf has amounted to about 125 million barrels of crude and condensate, and 280 billion cubic feet of gas. This aggregate has come from 49 oil fields and 22 gas or gas condensate fields. A similar number of gas fields are shut in, principally for lack of pipe line connections. Some of the oil fields also produce gas and condensate.

Of the 45 oil fields offshore from Louisiana, seven are in the over one-million-barrels-a-year class. One of the newest of this highly productive group is also the largest from the standpoint of output. This area, designated as South Pass Block 24 field, was discovered in 1950, and has produced almost 34 million barrels of oil.

However, all this production cannot be attributed to offshore, for this is one of the few fields that includes both land and water. It produced from the same reservoir as the onshore Dixon Bay field, which is now included in the Block 24 field.

The second largest Louisiana offshore field is the Bay Marchand Block 2 field. It has produced 17 million barrels of oil since its discovery in 1949. Close behind is the Main Pass Block 69 field, with almost 17 million barrels to its credit since 1948 discovery. The remaining four big fields, with discovery dates and cumulative oil production are: Main Pass Block 35 (1951) (12 million); Eugene Island Block 126 (1949) (7 million); Grand Isle Block 18 (1948) 5½ million); and West Delta Block 53 (1953) (2½ million).

**Reserves.** Little is known about the magnitude of offshore oil and gas reserves. In general, not enough development work has been done to evaluate the fields that have been discovered. However, it is an establishd fact that a good part of the discoveries made to date are important and will contribute substantially to the nation's hydrocarbon reserves.

Many believe that the surface is just being scratched—that future search will uncover many great fields similar to those that exist on the onshore portion of the Continental Shelf.

Ira H. Cram, senior vice president, Continental Oil Company, recently gave estimates of 620 million barrels of crude and condensate and 4 trillion cubic feet of natural gas proved reserves for the offshore region. He pointed out that the degree to which development has been carried on has not demonstrated the quality of discoveries made, and that current estimates are probably ultra-conservative.

Attesting to his conservative estimate, Cram made this statement: "It's a fair guess that as much as 14 trillion cubic feet of gas already has been discovered though only partially developed."

**Wildcatting Success.** The history of offshore discovery success has been exceptional. Wildcatters have amassed the enviable record of hitting the mark 35 percent of the time. The national average for many years has amounted to only a 12 percent success rate.

The record looks even more impressive with the realization that a fair portion of the finds are of giant proportions, or are likely to prove so when fully evaluated.

Last year's Gulf of Mexico exploratory drilling success was not quite up to the all-time standard. During 1956, the discovery record totaled 23 new fields—7 oil, and 16 gas. It took 89 wildcats to prove these areas, for a 26 percent success ratio. The batting average was 36 percent in 1955. The principal reason for last year's drop was the poor showing off the Texas coast where 17 tests showed nothing.

The bumper year for Texas was 1955 when two oil and four gas fields were discovered with 14 tests. That amounted to the amazing success rate of 43 percent. The same year saw 13 oil and 10 gas fields found in Louisiana waters by 66 wildcats for a score of 35 percent.

This excellent record has not been compiled without reasonable explanation. So far, operators have chosen the very best of their prospects for drilling. Naturally, this skimming of the cream has, and should, show the best results. It is not implied that the bright prospects have all been taken, nor that from now on discoveries will be harder to find.

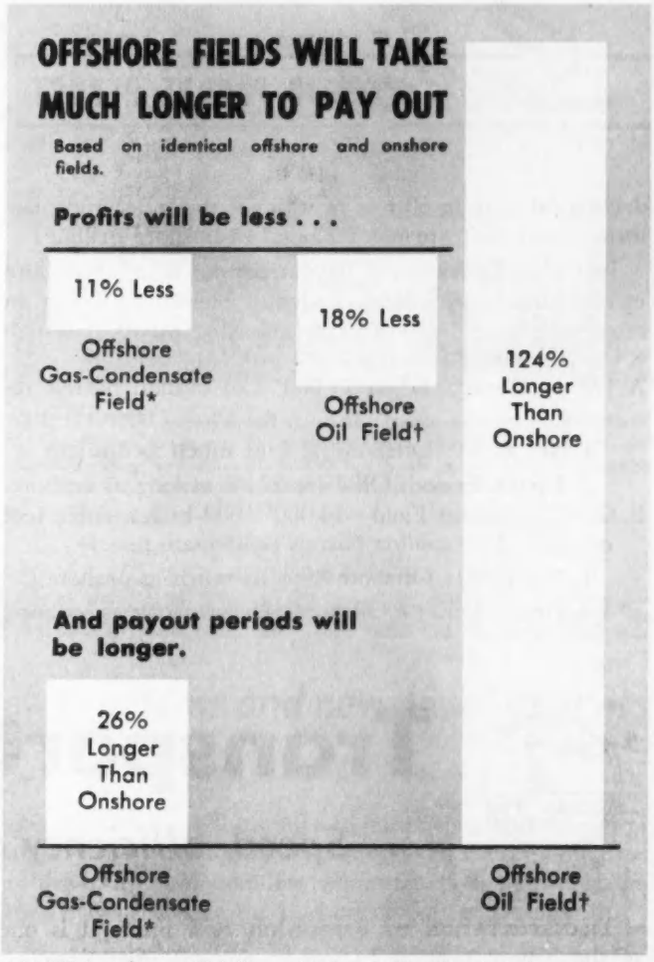
However, somewhere down the road there will be the time when more wells will have to be drilled for each discovery. It will never reach the onshore ratio, perhaps, for the costs are too great to drill prospects that do not show real promise.

**Offshore vs. Onshore Costs.** A company moving several miles to a new well location on land can expect little difference in normal drilling costs to comparable depths. However, if that move is made from a land location seaward into the Gulf of Mexico, previous cost records are practically worthless.

Just one of the offshore cost factors is labor. Not only does the labor force cost more initially, housing, feeding, transportation, etc., also run up the drilling bill considerably.

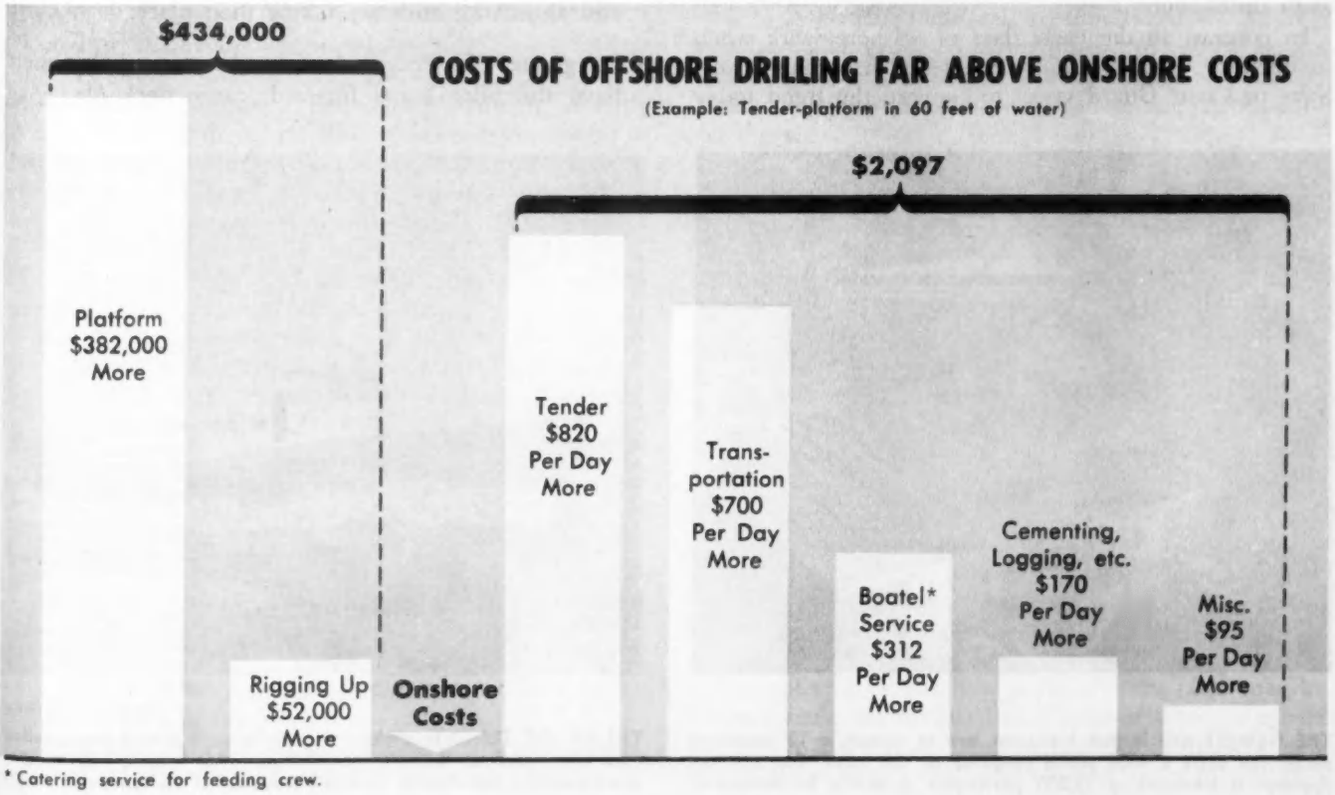
Supplies and equipment must be transported. Equipment must be of greater strength and capacity. Drilling platforms must be built in many instances and protective structures must be built around and over wellheads if the test is successful. These are but a few of the operations that make offshore drilling costs run higher than onshore operations.

The chart below will give some idea of the comparative costs of offshore and onshore drilling operations. The items include only the additional costs involved in


OFFSHORE FIELDS WILL TAKE MUCH LONGER TO PAY OUT
Based on identical offshore and onshore fields.
Profits will be less . . .
11% Less
Offshore Gas-Condensate Field*
18% Less
Offshore Oil Field†
124% Longer Than Onshore
And payout periods will be longer.
26% Longer Than Onshore
Offshore Gas-Condensate Field*
Offshore Oil Field†

* 14,000 feet deep—600 billion cubic feet & 30 million barrels condensate reserve.

† 10,000-11,000 feet deep—20 million barrels reserve.


COSTS OF OFFSHORE DRILLING FAR ABOVE ONSHORE COSTS
(Example: Tender-platform in 60 feet of water)
$434,000
$2,097
Platform $382,000 More
Rigging Up $52,000 More
Onshore Costs
Tender $820 Per Day More
Trans-portation $700 Per Day More
Boatel* Service $312 Per Day More
Cementing, Logging, etc. $170 Per Day More
Misc. $95 Per Day More

* Catering service for feeding crew.

drilling offshore in 60 feet of water with tender and platform—costs that are not included in onshore drilling:

Just what the expected payout periods may be offshore in comparision with land producing operations is also an interesting consideration. The following points out such a comparison of two types of producing fields:

A. Oil Field—10,000′ to 11,000′ (20 million barrels reserve).
   1. Net Profit: Offshore 82% as much as onshore.
   2. Payout Period: Offshore 224% as long as onshore.
B. Gas-Condensate Field—14,000′ (600 billion cubic feet of gas and 30 million barrels condensate reserve).
   1. Net Profit: Offshore 89% as much as onshore.
   2. Payout Period: Offshore 126% as long as onshore.

Photo by Jesse Grice

**ALL PHASES of offshore activity are dependent upon adequate onshore bases. On shore in the Louisiana area will be found thousands of acres devoted to supply depots, housing communities, production storage facilities, docks, heliports or airports, offices and other facilities. These are as much a part of offshore operations as the platforms and barges far from land.**

# Transportation Practices

## . . . Speed, efficiency and economy are the bywords

TRANSPORTATION OF PERSONNEL and material is one of the biggest expense factors in offshore operations.

Estimates place the annual cost average at more than $86 million. Thus, it is easy to see why operators are constantly seeking cheaper and more efficient ways to transport personnel, supplies and equipment to their offshore installations.

In contrast to the early days of offshore work when an operator was lucky if he could find a surplus Army, Navy or Coast Guard vessel to convert, the trend today is toward specialized transportation. Speed, efficiency and economy are the bywords.

Here are some of the changes these bywords have created:

- Wooden hulled crew boats are on the way out. Steel and aluminum hulls are taking their place.
- For greater efficiency and safety, the new supply vessels have the pilot house forward, cargo deck aft.

**THE NEWEST and largest helicopter now in service, a 12 passenger model can carry a 4000 pound cargo up to 100 miles. One offshore operator is transporting 18,000 passengers a month by helicopter.**

Photo by Jesse Grice

**THE LATEST TREND in offshore transportation is toward metal-hulled crew boats such as the one shown above. They require less maintenance—receive less damage from bumping against platforms and docks.**

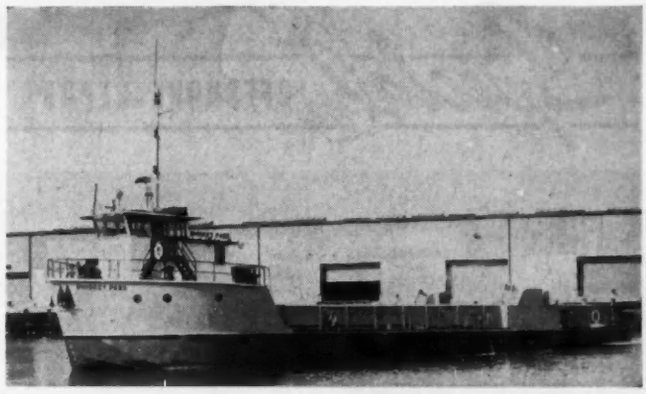
- Offshore operators, particularly those with two or more installations, are making increasing use of helicopters.

  As drilling goes farther out to sea, demand for airborne transportation will increase.

- A growing number of operators (at least 80 percent) are contracting transportation.

The trend toward contracting transportation is supported by three important economic factors in favor of the offshore operator:

1. Capital investment is someone else's problem.
2. No maintenance costs.
3. Need to build a large organization that one day may not be needed is eliminated.



**THIS 119-FOOT supply vessel shows new trend—pilot house in the bow. At least one company is building vessels to carry both personnel and supplies. There are more than 350 tug boats, crew boats and supply vessels now serving offshore operations.**

# Communications Practices

## ...Rapid growth spawns new problems and new developments

SPEED AND FLEXIBILITY of offshore operations are increasing so fast conventional communications systems are being left in their wake. Result: Serious problems are arising from over-crowded conditions.

Two-way radio (FM) is over-saturated and will become more so as offshore activity picks up. The ship-to-shore (Bell Telephone) system is just as crowded. In some instances there are two to three hour delays in placing calls. Offshore companies are exerting every effort to avert what could lead to a general communications jam-up.

Some of the new developments include:

**Micro-Wave.** Magnolia Petroleum Company recently installed the industry's first offshore micro-wave system to provide communications and control of its pipe line gathering system at three Louisiana offshore installations. Company benefits will be threefold: (1) There will be no more problems with crowded VHF conditions. (2) Skip interference will be eliminated. (3) Complete privacy for inter-company communications.

At first, the company will use three channels—two for voice communications and the other for VHF control. As automation increases, additional channels will be available for telemetering, etc.

**Underwater Cables.** Two companies are actively interested in underwater cables at the present time. One has been using a cable network in the Louisiana Gulf since 1953, and now is considering the possibility of laying a second cable. Another company is laying cable to the Cameron field.

The cable now in use is two to three inches in diameter with six control wires and three power wires. New cables will be an inch in diameter.

The cables are ideal as an intra-field communications network. Their uses include telephone communications, remote control, well testing and data accumulation, power and telemetering for short distances. In short, submarine cables will provide another communications path to shore, thus helping to take the load off of present systems.

**Picture Transmission.** An experimental facsimile system is operating between Harvey and Lafayette, La., a distance of 150 miles. Plans are being considered to put in equipment at Leesville and possibly New Orleans.

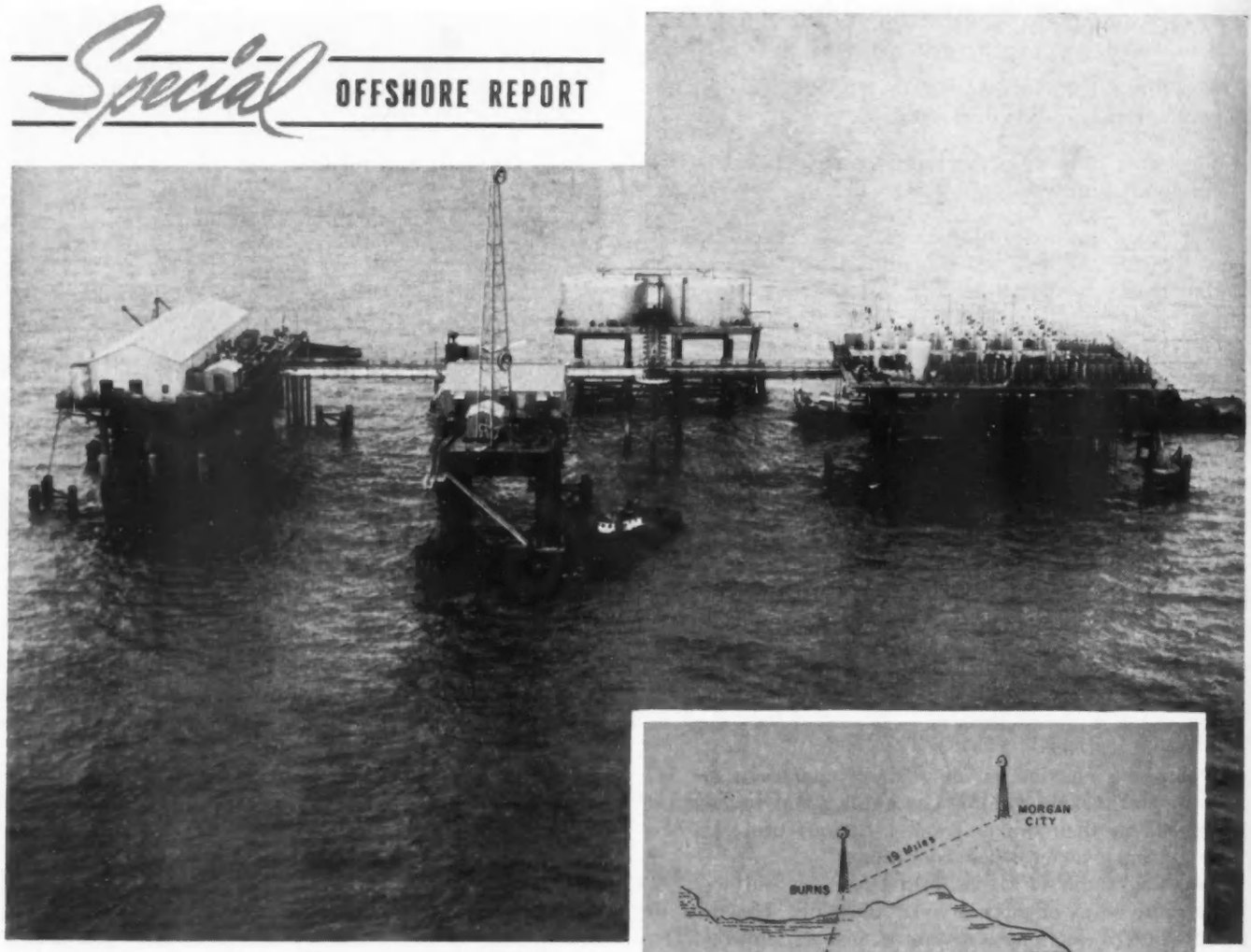
If plans materialize, geologists at each location will be able to look at the same well log simultaneously. Approval can be made on actual forms instead of recopying. Facsimile could be used just as well for various types of communication between offshore operations and central points on shore.

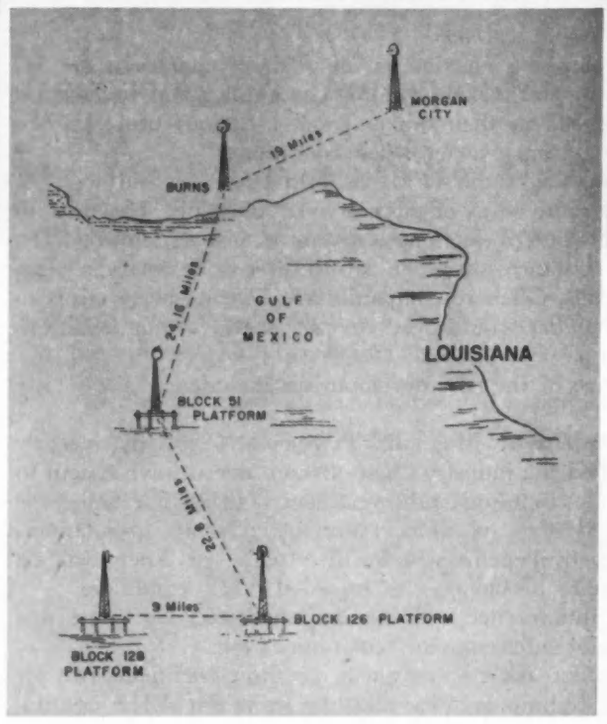
**Well Testing and Data Transmission.** This system periodically transmits such information as amount of oil and gas production from an offshore platform. The information is transmitted by dial-like d-c pulses via submarine cable to a teletype tape punch at the tank terminal onshore.

**Industrial Television.** More in the nebulous stage are studies to determine possible uses for television in offshore operations. One thought is to place cameras in such locations as the drilling floor and mud pits. An engineer at a central point could watch a "live" performance of these operations from any number of offshore locations.

Other uses might include underwater inspection of drilling sites prior to moving in with a drilling structure. Also, underwater inspections could be made of pilings, pipe lines, header connections and wellhead connections.

No matter how practical some of these ideas may be, the fact must still be faced that none of them have been adopted to any extent. The conventional methods of communication are still the most popular, even though they






**SHOWN ABOVE** is one of five microwave towers that will provide 80-mile communications link between three Magnolia Petroleum Company platforms and two land stations (see inset). Equipment is similar to that used by several onshore oil and natural gas companies.

pose problems. Here are some suggestions that will help ease the over-crowded conditions:

1. Set up an organization structure to give more authority to the man on the job, thus cutting the need to constantly check with the district or division office.
2. Area superintendents should request personnel to shorten conversations.
3. Plan ahead to eliminate routine requests.
4. Keep personnel informed about the problem of overcrowded communications systems.

**Offshore Personnel.** The need for more personnel has increased with the yearly growth of offshore activity. However, the problem of hiring additional personnel has decreased.

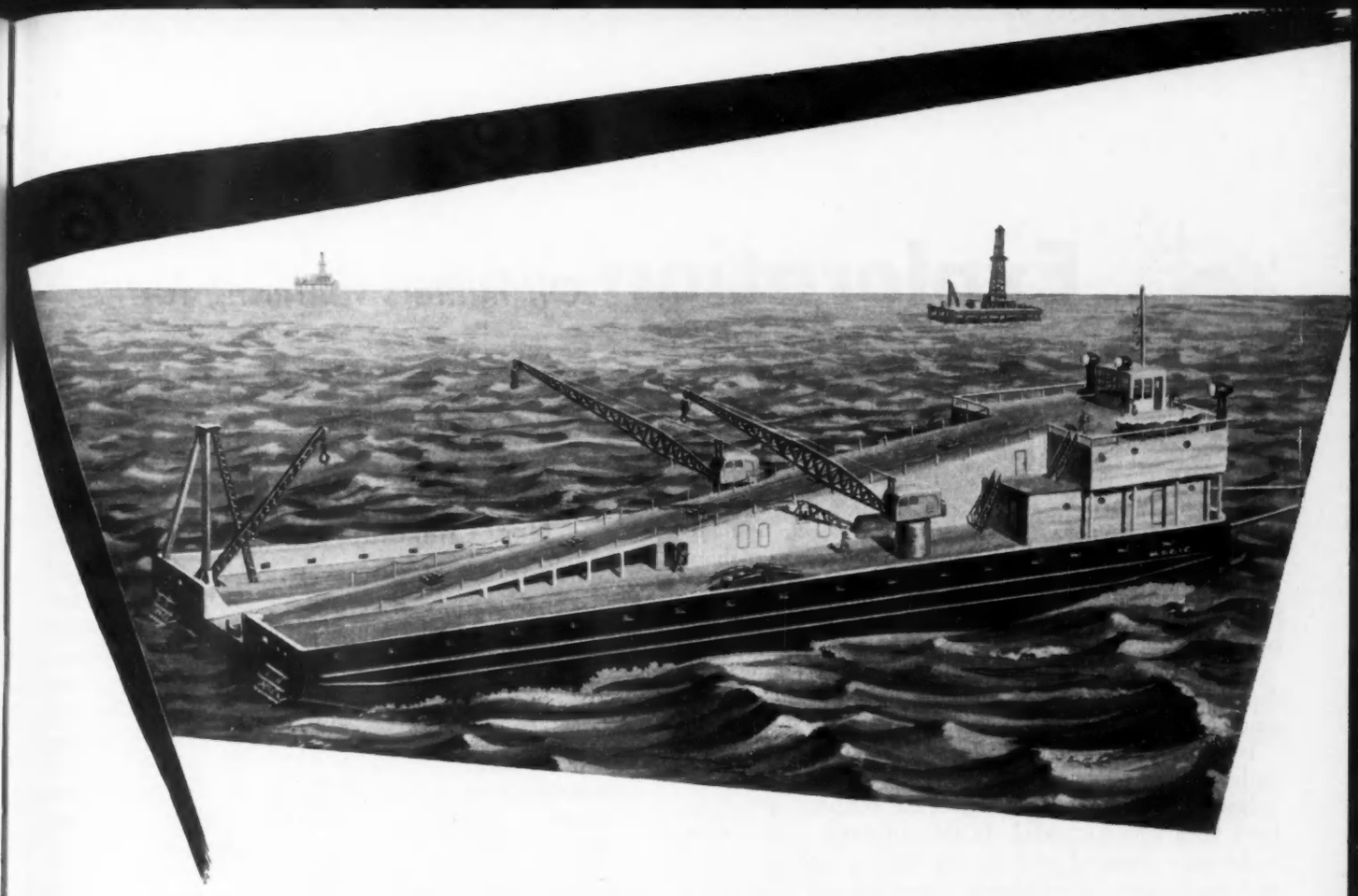
In support of this statement, the larger companies report that currently they are having no more trouble obtaining offshore employes than onshore. The reasons are two-fold: More work is readily available offshore—the opportunity for a fatter pay check is greater than onshore.

When offshore activity began, companies found it difficult to find men who were willing to be away from their families several days at a time. As activity stepped up concessions were made to minimize the problem.

Although the unit rate of pay is the same as onshore, the hours of overtime are greater. Estimates are that roughnecks, roustabouts, gaugers and pumpers average slightly less than 11 percent more annual take home pay than their colleagues who work onshore.

Offshore workers also have excellent accommodations. In nearly every instance, modern centrally heated and air-conditioned quarters are provided, including excellent recreation facilities.

Other factors influencing the present favorable offshore personnel situation include decided improvements in transportation and communications, which are discussed earlier in this report.



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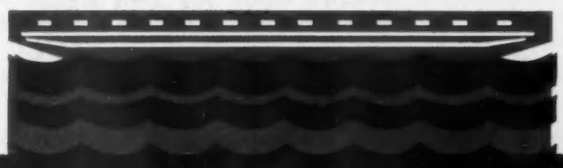


**P. O. Box 9746**
**Houston 15, Texas**

# Exploration *Oil hunters venturing farther*

OFFSHORE EXPLORATION programs are becoming more and more widespread. Previously limited to near-shore areas, wells are now being drilled in depths exceeding 100 feet of water. In the Gulf of Mexico, some companies are conducting seismic work in areas up to 300 feet in depth.

In the future, offshore drilling will not be limited by depth of water, but by the demand for oil. Drilling units may operate at the sea bottom.

If the well is completed, the rig may be replaced by underwater production facilities.

New seismic methods designed for offshore operations have been very successful. In fact, offshore seismic work is the only phase of offshore exploration that is cheaper and faster than the equivalent operation onshore.

Records acquired from offshore seismic work in the Gulf of Mexico have generally been good, with only a few localized areas proving unsuitable to satisfactory seismic interpretation from available records. Hence, seismic work has strongly tended to overshadow the importance of other geophysical methods in the offshore Gulf.

The comparative uniformity of the sea bottom in the Gulf offshore from Louisiana and Texas may be a factor in the general success of future seismic operations. Exceptionally bad-record localities may reflect local variations in the composition, degree of hardness, density and other characteristics of the Gulf floor.

One hazard in offshore seismic work is the so-called "bubble effect," whereby multiples may show up in seismic records which may lead to erroneous interpretation of many non-existent subsurface anomalies. Such multiples can result from reflections of impulses from the sea bottom itself, rather than from subsurface horizons, this can lead to erroneous seismic structural pictures unless extreme caution is exercised in interpretation. If there is a big change in the density of the bottom as compared to that of the water, the multiple effect should be watched for.

Since offshore drilling is so expensive, considerable effort has been directed toward minute study of seismic velocities where they can be checked with well control, toward the end that stratigraphic thickening and thinning can be interpreted, as well as structure. This is particularly important in the Gulf of Mexico where the more highly-developed Miocene sand fairways are so important to the establishment of economic production and large reserves. However, many oil men are not satisfied with progress so far toward the horizontal application of seismic data to determination of lithology, sand development, and location of marine wedges.

## New Challenge for Geologists

Geologic thinking, techniques, and operations have been revised greatly as part of the development of offshore drilling and production. Surface geologists have had to become skin-divers and expert swimmers. In some cases, they dive below the surface of the sea to examine bottom sediments, check dips and strikes of bedrock where it can be found, and to bring back rock samples for further study.

Skin-diving geologists off California have submerged to examine oil and gas seeps, and to provide data for the mapping of surface structures identifiable on the sea floor.

The new marine sonoprobe, recently developed by Magnolia Petroleum Company and its parent firm, Socony Mobil Oil Company, may be of help in sounding

**Divers study samples from ocean floor . . .**

**SOCONY MOBIL skin divers examine bottom sediments collected during underwater exploration in the shadow of offshore drilling rig.**

## *from shore... future activity may be limited only by production needs*

out shallow subsurface horizons in shales and marls. Such an instrument might be the equivalent of "thumping" on land, and could, if successful, provide shallow structural data similar to the function of a shallow core-drill operation.

Subsurface geologists have had to revise their thinking and techniques because most offshore drilling is done directionally, whereas the majority of onshore wells are drilled vertically. The third-dimensional view thus has to be envisioned much more strongly by geologists interpreting offshore drilling data, particularly in the determination of datum points and the locus of faults. This is particularly true in the Gulf of Mexico where almost all of the features now being drilled are salt domes, with inherent highly-complicated fault patterns. Some wells have been deflected as far as 7000 feet in the horizontal direction from the wellhead.

With many directional holes being drilled from the same platform, and many of them being whipstocked off a second time for geological information or because of an unsuccessful fishing job, the job of subsurface geological interpretation is complicated even further. The subsurface geologist will invariably have more and better subsurface control on deeper horizons than on shallower ones, because the shallow points tend to be clustered together with the deepest datum points being the most widespread and useful.

The reverse is generally true onshore, because more shallow holes are drilled, on the average, than deep ones. Hence, at least one technique widely used in subsurface geological exploration, namely isopach, is less useful offshore than onshore since ordinarily there will be fewer well-distributed shallow datum points than deep ones. This is another impetus for development of techniques

**. . . then go down again to examine sediments and check dips and strikes of bedrock**

**THIRTY-FIVE FEET underwater in the Gulf of Mexico, skin diver reaches for geology lab's specimen collection. This is all in the day's work for offshore surface geologists. They often explore the Gulf's depths to check dips, strikes of bedrock, and to bring back rock samples.**

# Why General Electric Drive Proves Best For Oil Well Drilling Rig Electrification

**1 Control simplicity inherent in motor and generator design.** General Electric's differential generators eliminate the need for complicated external current and voltage regulating controls, feed-back systems, and torque limiting devices used in some makes of electric drive. Moreover, General Electric's familiar air throttle system eliminates the individual exciters for each generator. The G-E shunt motor will not run away in case of load loss and therefore requires no speed-limiting control devices. This motor has excellent braking characteristics without any added controls. All control provided for the General Electric drive system assures complete regulation of speed and torque simply and efficiently.

**2 Can be used with almost any popular oil field engine.** A great number of popular oil field engines can be used with General Electric drive including spare engines which you may have in stock. The advantage here is that preference for and familiarity with a particular make of engine need not be sacrificed to gain the benefits of this reliable, efficient, low-maintenance drive system. Parts programs need not be complicated by the addition of a different line. General Electric and the engine builder co-operate so that engine-generator sets are furnished as a completely engineered package. G.E. has two generators available for oil field applications. The GT558R1 generator is a single-bearing, flange-mounted, self-ventilated machine with the following input horsepower ratings: 200 hp at 1200 rpm, 240 hp at 1400 rpm, 280 hp at 1800 rpm, 320 hp at 1800 rpm, 340 hp at 2000 rpm, 350 hp at 2100 rpm. The GE752J generator is a two bearing, single shaft, separately ventilated generator. (It is also available as a two shaft extension machine.) This generator has the following input horsepower ratings: 450 hp at 850 rpm, 550 hp at 900 rpm, 600 hp at 1000-1300 rpm. The GE752H2 motor rates 625 hp continuously and up to 1000 hp for hoisting at 950 rpm.

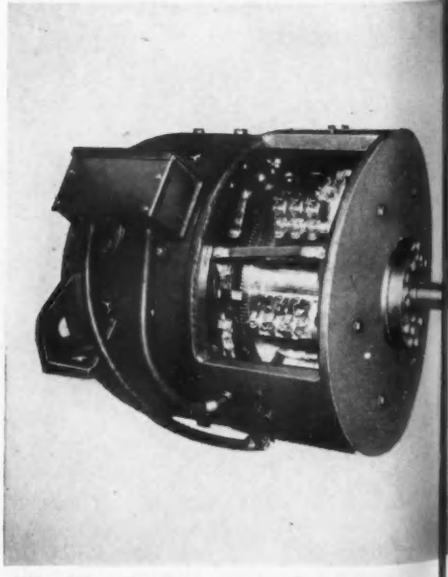
**3 Designed and built by the original manufacturers of electric drive.** General Electric is primarily an electrical equipment manufacturer with years of experience in the manufacture of electrical apparatus. The simplicity and flexibility which mark General Electric drive are the result of leadership in the electrical field. The electric drive that will mean so much to your rig operation and to your cost per foot of hole has been pioneered and developed by G.E.

For more information, call your nearest G-E Apparatus Sales Office. (Principal drilling offices in Dallas, Houston, New Orleans, Denver, Tulsa, and Los Angeles.) Locomotive and Car Equipment Department, Erie, Pa. 115-22

*Progress Is Our Most Important Product*

GENERAL ELECTRIC

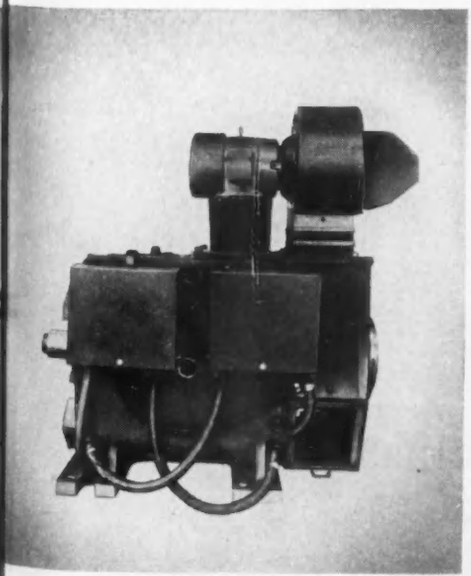
**PRINCIPAL**



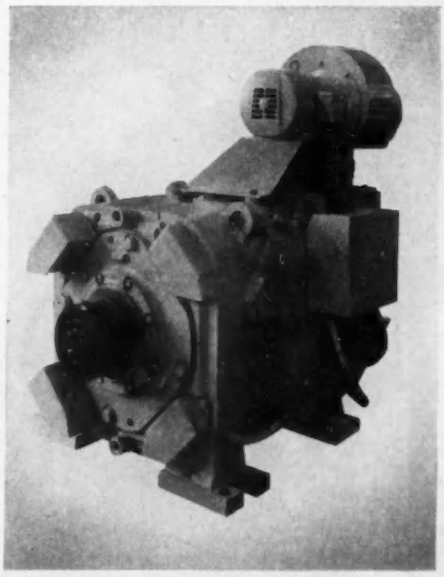
GT558R1 direct current main generator with inspection covers removed.

Operator at drilling controls of General Electric equipped rig built for Shell Oil Company by Ideco, one of the Dresser Industries. Standard air throttles are used for speed controls. These can be incorporated in the draw works console with other air controls, simplifying operation.

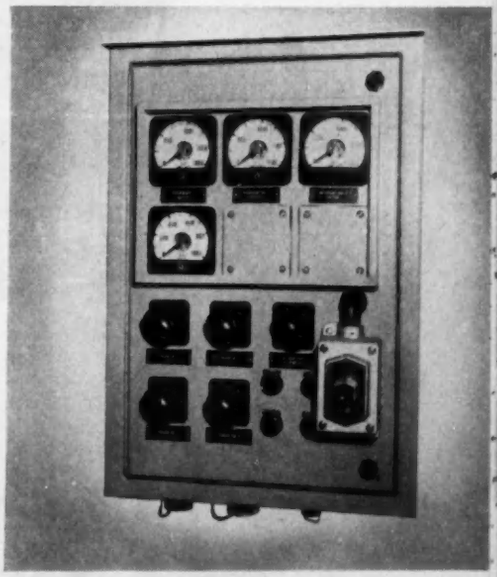
## GENERAL ELECTRIC DRIVE COMPONENTS:



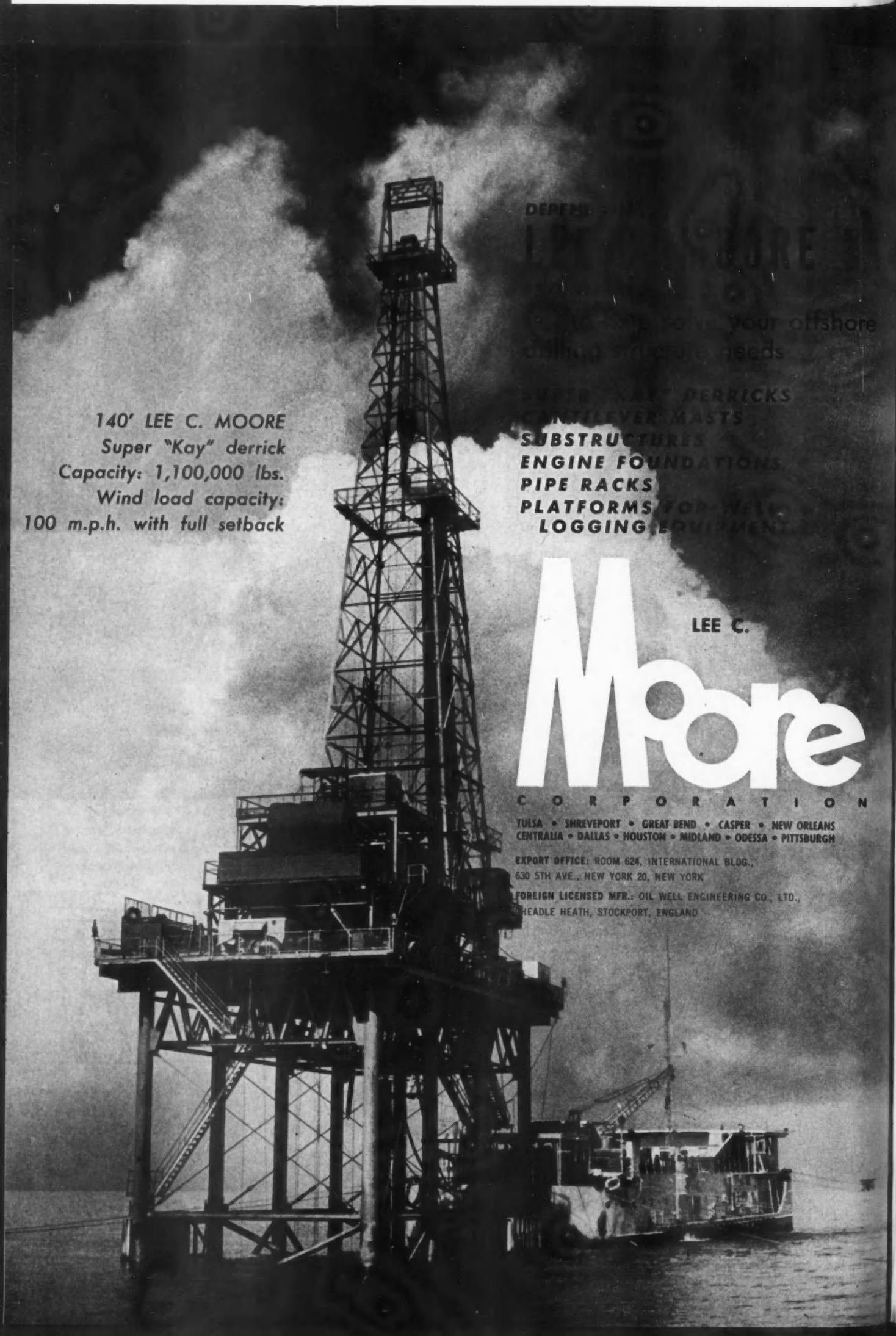
GE752J direct current main generator with top-mounted blower assembly.



GE752H2 direct current, 1000 hp motor with top-mounted blower assembly.



General Electric control console for use at driller's position.


140' LEE C. MOORE
Super "Kay" derrick
Capacity: 1,100,000 lbs.
Wind load capacity:
100 m.p.h. with full setback
SUBSTRUCTURES
ENGINE FOUNDATIONS
PIPE RACKS
PLATFORMS
LOGGING
LEE C.
Moore
CORPORATION
TULSA • SHREVEPORT • GREAT BEND • CASPER • NEW ORLEANS
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FOREIGN LICENSED MFR.: OIL WELL ENGINEERING CO., LTD.,
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to measure stratigraphic thicknesses from seismic records by means of recently-developed types of specialized plotters.

## Cost Is a Major Factor!

Micropaleontology, stratigraphy, and lithology of cuttings are all more important in offshore wells than onshore. It is harder to realize anything like $2 million worth of geological information from a dry hole offshore than to get $100,000 or $200,000 worth onshore.

It could be said that the geologist has a bigger responsibility on offshore wells than onshore wells, since there is more at stake. However, to the individual geologist, it does not matter much whether the well costs $50,000 or $2 million. It is a major responsibility in either case. And a geologist is much less apt to be criticized for being too thorough and too careful on an offshore well than onshore, since the operator expects huge costs offshore.

## What's Happening In California?

• Nearly the entire length of the California shore line has been prospected to some degree. By far the major effort ranges from San Luis Obispo County South to the Orange County-San Diego County line. Areas which might contain offshore extensions, or trends, of known onshore producing fields, include the Santa Maria-San Luis Obispo area, the Ventura area and the Los Angeles-Orange County area.

Most of the California offshore exploratory activity has been confined within the 3-mile limit. At some points within this 3-mile area the ocean floor drops off sharply to depths greater than 600 feet, mainly from ½ mile out to perhaps two miles, depending upon the particular area.

The accompanying table shows the approximate acreages that are involved in leased and unleased State and Federal submerged lands.

• Exploration tools and techniques used on the West Coast reflect the substantially different submarine conditions found in those waters. Deep water, often in excess of 600 feet within only a few miles from shore, has created the need for a different approach to the problem of drilling core holes.

Much early work included the use of small converted PC types of craft equipped for over-the-side drilling using light equipment. Later, another idea was adopted; a technique that has grown in popularity and promises to become the principal answer to the problem of drilling in waters up to several hundred feet in depth.



This technique involves drilling through a 10-foot well cut through the center of the barge just forward of the bridge and, using a 55-foot mast, drilling through the ship well; the natural roll of the ship being counteracted and compensated for by some ingenious adaptations of torque converters in the drawworks, use of slip joints in the drill string and other innovations.

Such techniques involve the use of a blow-out preventer and rotating packer device anchored on the ocean floor; guide lines extending between that unit and the ship permitting the drill string to re-enter the well whenever the drill string is pulled for changing the bit or running of electric logs, the latter also being standard equipment on most of the offshore exploration craft.

Although designed primarily for 500-foot core drilling in evaluating unproven offshore areas, such drill barges are known to have drilled to depths of at least 5000 to 6000 feet on some leased lands. That this through-the-ship drilling technique has merit and signifies a trend in the development of offshore drill barges, is seen in the recent outfitting of a 260-foot by 48-foot beam barge capable of drilling to depths of between 8000 and 10,000 feet using 4½-inch drill tubing. This 2700-ton craft, equipped with a 98-foot derrick, so far is the largest floating exploration type vessel operating in Pacific Coast waters.

During the early development and exploration of California offshore areas, and the practice still is employed by some, outcroppings of rock on the ocean floor were studied, samples taken, and strikes and dips taken by geologist-divers equipped with special instruments capable of being operated under water. Such exploration techniques are particularly useful in shallow waters lying offshore from known onshore structures; where some idea of the structural picture could be obtained without, or at least preliminary to, the use of offshore coring operations.

Grouping or alignment of seaweed visible in aerial photographs also has provided clues to the geologist studying possible offshore structural conditions.

***Here are the approximate acreages involved in State and Federal areas in less-than-600-foot waters along the Southern California Coast (as of Feb. 1, 1957)***

| | STATE AREA | | | FEDERAL AREA | | | TOTAL AREA | | |
|---|---|---|---|---|---|---|---|---|---|
| DESCRIPTION | Along Mainland | Surrounding Islands & Shelf Banks | Total | Along Mainland | Surrounding Islands & Shelf Banks | Total | Along Mainland | Surrounding Islands & Shelf Banks | Total |
| Area Already Leased..... | 17,000 | 0,000 | 17,000 | 0,000 | 0,000 | 0,000 | 17,000 | 0,000 | 17,000 |
| Area Available for Leasing | 374,000 | 444,000 | 818,000 | 678,000 | 565,000 | 1,243,000 | 1,052,000 | 1,009,000 | 2,061,000 |
| Restricted Area..... | 433,000 | 0,000 | 433,000 | 0,000 | 0,000 | 0,000 | 433,000 | 0,000 | 433,000 |
| Total..... | 812,000 | 444,000 | 1,268,000 | 678,000 | 565,000 | 1,243,000 | 1,502,000 | 1,009,000 | 2,511,000 |

**Note: Santa Catalina and San Clemente Islands have been omitted.**

**1** MOST RECENT and so far the largest offshore barge on Pacific Coast is the 260-foot long, 48-foot beam converted YFNB used by the CUSS group (Union, Continental, Shell, Superior) with Union Oil as operator. Barge has 98-foot derrick, uses 4½-inch drill tubing and can drill to 10,000 feet. The drilling is carried on through a well amidships. Moored alongside is a 298-ton, over-the-side drilling PC boat used for shallow core drilling.

# Drilling Practices ...one of the most

AT PRESENT, drilling along the Gulf Coast seems to be limited by structural design capacity to 100 feet of water for mobiles and 125 feet for self-contained platforms. Since the start of the first offshore drilling, when adaptations of barge rigs were used and wooden platforms were erected in the Gulf, drilling structures have evolved into three major types.

- Mobile platform or barge
- Minimum deck platform with tender
- Self-contained platform

In California, converted LSM's have been used as floating platforms for core hole drilling. Recently a 98-foot derrick has been mounted on a converted YFNB for drilling to 10,000 feet with 4½-inch drill tubing.

There are many versions of these basic types of structures. The style and design depend to a great extent on company policy, design engineers and the expected service to which the structure is to be committed. The final test for structures designed for the Gulf Coast is their ability to withstand the severest hurricane based on 100 years probability.

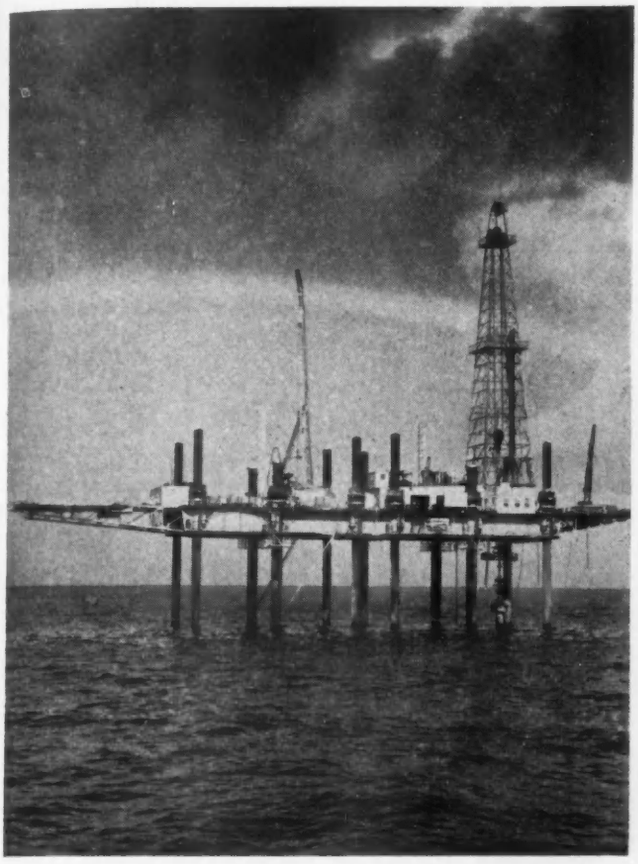
Many new trends in design have come to the fore in recent years. Some of these are:

- Fabricated legs constructed with tubular members to reduce the effect of wave forces.
- Streamlined hulls to reduce wave force effect and scouring action.
- Vertical columns that provide sinking stability and lower construction cost.
- Derricks cantilevered over the side of the structure to eliminate the narrow well slot and wellhead damage when moving on or off the well.
- Equipment aboard the drilling structure for installation of wellhead jacket to eliminate use of a construction barge.

These are just a few of the many new and different features that are being added to existing designs, along with the development of entirely new structures to more economically carry the search and finding of oil into deeper waters.

Self-contained platforms are more popular for development work while the mobiles are preferred for exploration drilling. Tender-type operations will increase for exploratory drilling.

During 1957 and 1958, mobiles should account for 80 to 85 percent of the exploration drilling. Tenders will ac-



**2** "MR. GUS," shown above before it capsized, illustrates an elevated deck, self-contained mobile supported by piling and submersible hull. It is shown drilling in 93 feet of water, 63 miles offshore, for Shell Oil Co.

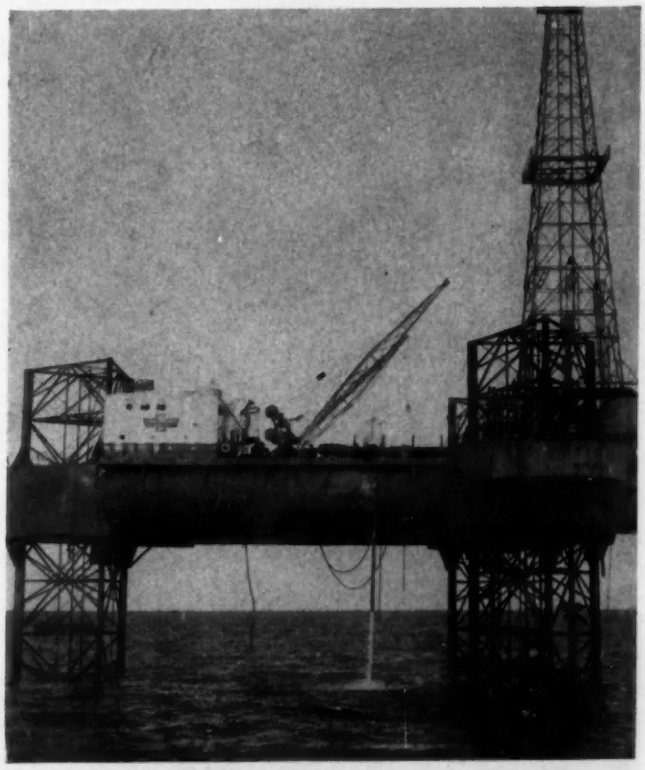
**3** ONE OF THE NEWEST and largest offshore mobile platforms is the Kermac 47 shown at first location for Phillips Petroleum Co. in the Eugene Island area. Rig is cantilevered 55 feet over the side during operations.

## *challenging phases of the industry*

count for the remainder. By 1960 mobiles will be drilling approximately 75 percent, and will decrease even further in the next ten years. Mobiles will drill about 5 percent of the development work in 1957 and future years probably will not drill any of the development wells. Tenders and self-contained platforms will split development drilling approximately half and half.

Mobile operations are now limited to water approximately 100 feet deep. However, there are two under construction that will exceed this depth. A Glasscock barge designed for operations in 150 feet of water may show a trend toward the use of mobile units in deeper water and provide valuable information on this type of operation.

Operators are still very much in doubt as to what method will be used when water depths increase to 250 and 300 feet. The use of a floating-type structure, as the converted ISM or YFNB used in California waters may provide some valuable data and also establish a trend toward this type of drilling. There are any number of innovations for this type of drilling platform including the use of knuckle joints in the drill string, flexible drill string members, gimble-mounted rotary tables, etc.



**4** ONE OF THE MOST REVOLUTIONARY structures to date is Zapata Offshore Co.'s "Scorpion." A mobile self-contained elevating-deck type structure, it moves to location with deck floating. The spuds or feet are then lowered to the bottom and the deck is elevated.

*More Offshore Structures Shown on Next Page*

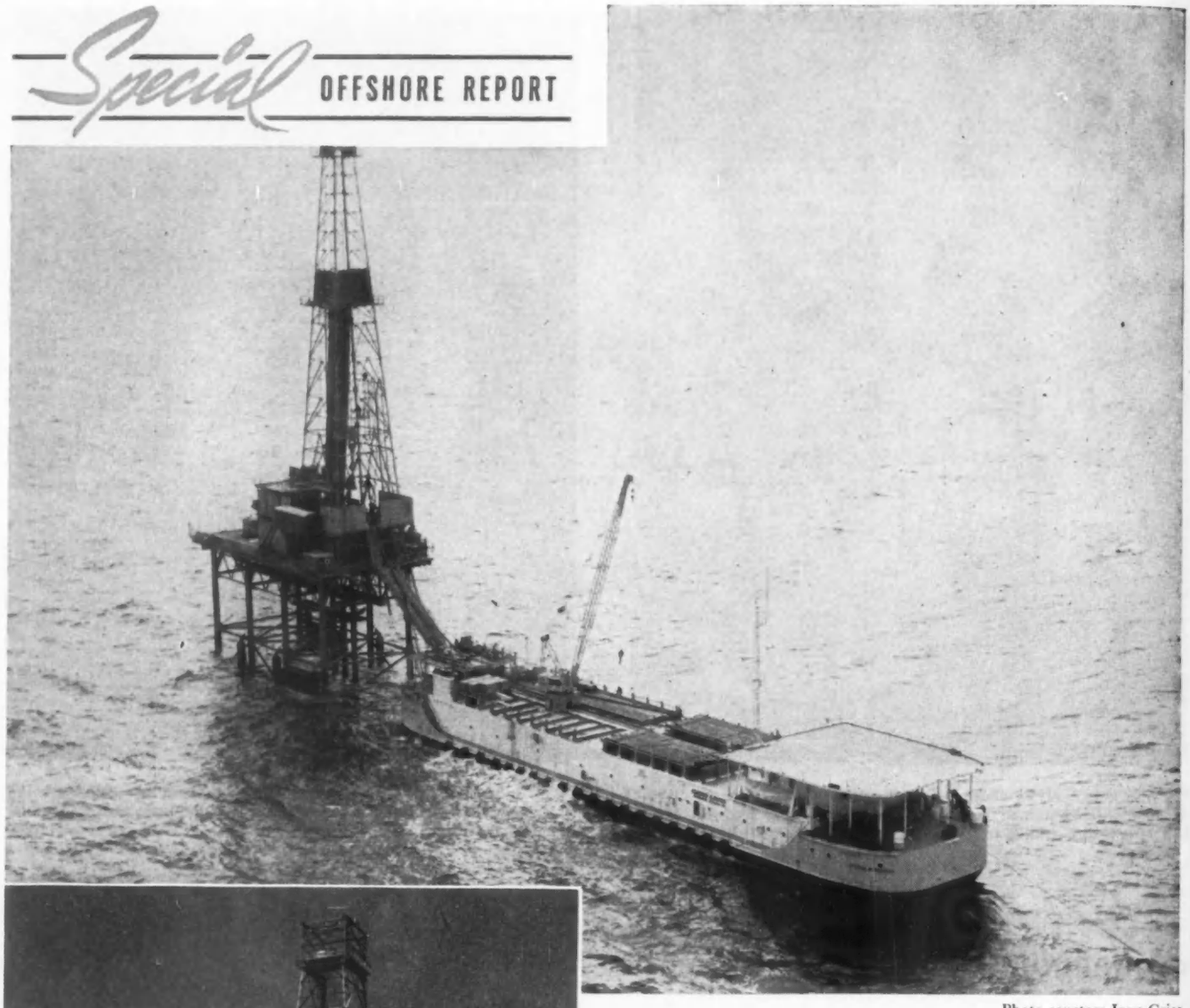
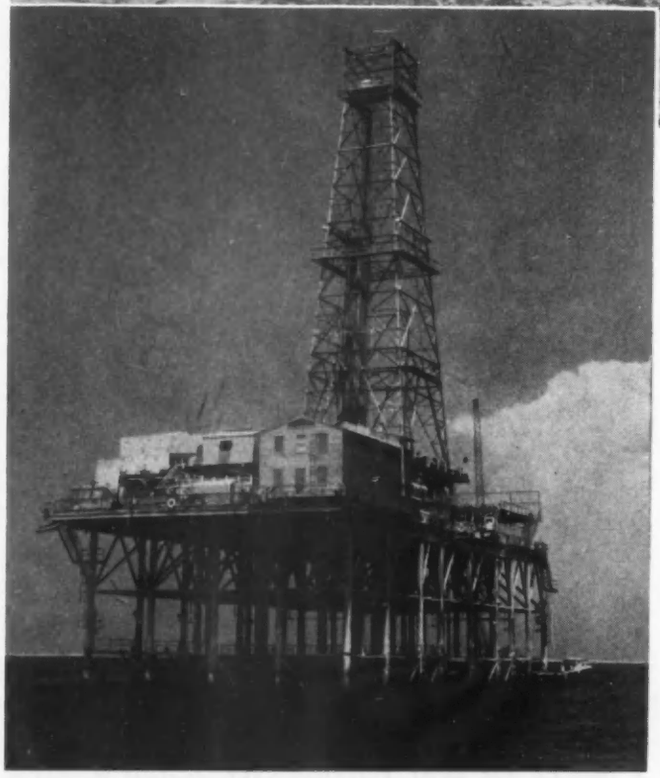
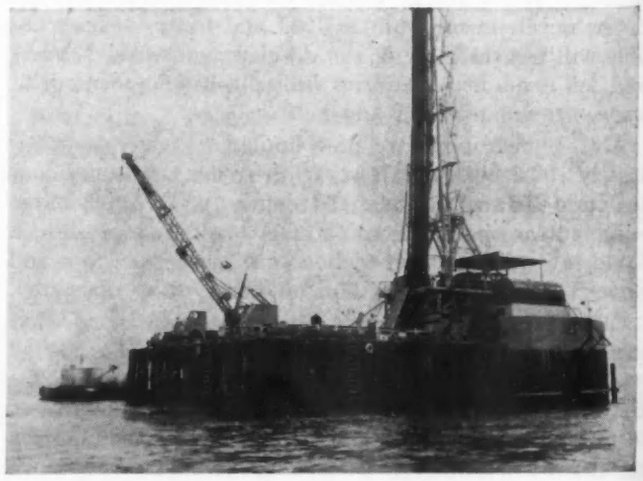


Photo courtesy Jesse Grice

**5** SHOWN ABOVE is the tender-platform type of operation. Tenders house the men and supplies. Also, most of them contain the complete mud system and power units for drilling. Note the extensive system of anchoring which is laid out both fore and aft. Anchoring is one of the major problems in this type operation.



**6** SHELL OIL COMPANY's Rig 54 on location in Block 42 at the mouth of the Mississippi River is an example of the self-contained type of drilling structure. Air-conditioned quarters for more than 40 men are provided. Note the wide water table on the derrick for multiple well drilling.



**7** MONTEREY-TEXAS COMPANY's 75-foot diameter island and attached wharf built in 1952. In 45 feet of water about 1½ miles off Seal Beach, California, the island since has been modified and a second deck added to permit the drilling of ultimate total of 70 wells. Rig is now drilling 21st well.

## How Offshore Rigs Compare . . .

| | No. Available or Under Construction | Design Depths | Used For | Best Suited To | Advantages | Disadvantages | Comparable Costs Above Onshore Costs for 12,000′ Well in 60′ of Water | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Platform or Well Protector | Rig Up | Additional Costs of Drilling and Completing |
| I MOBILE<br>A. Fixed Deck<br>B. Elevating Deck<br>C. Elevated Deck<br>D. Floating Type | 42 | 20–125 | Exploration & Development | Exploration | 1. Quick & inexpensive moves.<br>2. Drill single vertical holes rather than clusters. | 1. High initial cost<br>2. High daily operation cost.<br>3. More vulnerable to bad weather. | $ 75,000 | $20,000 | $850,000 |
| II MIN. DECK W/ TENDER<br>50′ x 100′ | 48 | 103′ | Exploration & Development | Exploration | 1. Low initial platform cost.<br>2. Recovery of all except pilings on dry holes.<br>3. Tender withdrawal in bad weather.<br>4. Platform can be expanded to self contained. | 1. High cost of platform recovery on dry hole.<br>2. Tender anchoring in deep water.<br>3. Cluster of directional wells increases loss risk.<br>4. Extra marine equipment and personnel. | 382,000 | 52,000 | 685,400 |
| III SELF-CONTAINED MAX. DECK<br>220′ x 706′ | 37 | 112<br>*200′ | Development | Development | 1. As many as 12 wells from one platform.<br>2. Good resistance to bad weather.<br>3. Less downtime for bad weather.<br>4. Not restricted by water depths up to 200 feet. | 1. High initial cost precludes use for exploratory drilling.<br>2. Dry holes raise per well cost. | 774,000 | 57,000 | 538,000 |

* Design Possibilities.

## Land vs. Offshore Operations

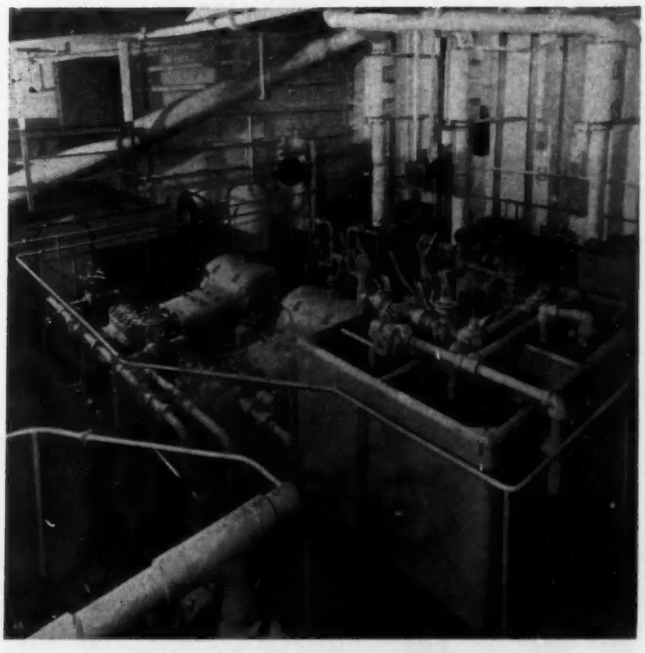
The drilling contractor with land operations who plans to go offshore must make a drastic change in his equipment and operations. Over-all costs will be in the neighborhood of $250,000. Everything from the derrick to the substructure must be changed.

The problem of logistics is considerably greater than in onshore operations. Land bases must be established to supply the operation. Transportation and communications must be provided. Upwards of 40 men must be quartered and fed and facilities must be on hand for their leisure hours.

The work load is different from onshore operations. Out on the water there are a number of different work schedules in effect but the more popular one seems to be 12-hour tours for ten days then five days off. Mechanics, welders, engineers, geologists, logging and mud engineers, cooks and clean-up men all come under the toolpusher or superintendent's jurisdiction, adding just that many more problems to his usual task of drilling a well.

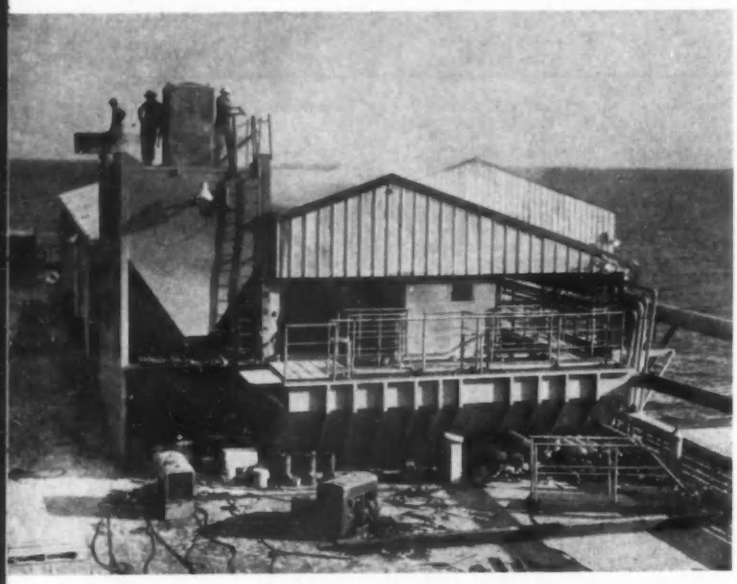
The land-based toolpusher who moves offshore soon finds he cannot rely on last minute planning and quick trips to the supply store, but he must have his operations planned well in advance. Everything must be ordered not just minutes or hours, but days in advance to fit the over-all operation.

Changes in crews and drilling and completion operations must be coordinated with the company's offices, land base, boats, planes and the drilling operation. This requires not only good planning but also a network of communication, including ship-to-shore radio and radiophone plus many different sizes and types of work boats, crew boats and helicopters. (See Transportation section of this report.)

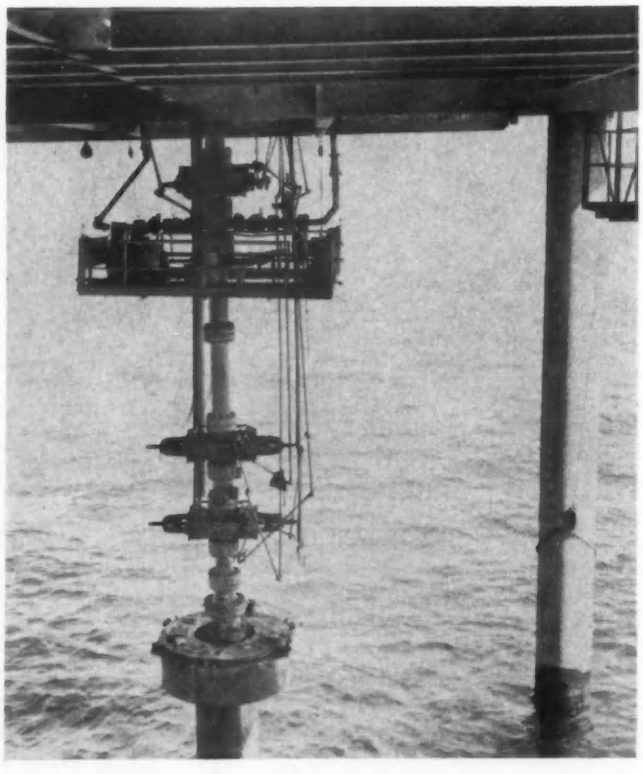


**TWO HIGH PRESSURE triplex pumps and a mixing tank are shown in forward hold of a tender. Installed as permanent pieces of equipment, they cost the contractor approximately $100 per day, even when on stand by duty.**

Because of unforeseen difficulties such as weather, equipment breakdown, etc., it is also necessary from an economic standpoint to have logging and cementing equipment at the location during practically the entire operation. This equipment is built into tenders and mobiles. Operators are flown out in plenty of time to be ready when the equipment is needed.



BULK MUD IS UNLOADED into 2400 cubic-foot storage bin from 50-sack skip bucket. The active mud pit is shown in foreground. Both mudline to the stand pipe and the return line can be seen at right. Besides the storage bin, an additional 5000 sacks can be stored on deck in skip buckets and a 37 by 50 foot room is available for storage of cement and mud additives.



WELLHEAD CONNECTIONS for blowout prevention are shown above. Three 1500 series ram type preventers are being used. Various types of these preventers must be used for the different size casing and bit programs. The use of three sets of preventers also complicates manifolding. Note number of air lines and also the high pressure kill lines.

## How the Mud Program Compares

The drilling program itself is similar to onshore drilling in almost every respect except that safety is paramount.

The drilling mud program is comparable to onshore operations in that lime base mud, particularly a new calcium chloride mud, is used up to temperatures of 300° F. Above 300° F. a calcium surfactant developed by the Magnolia Petroleum Company is used. These surfactants have been used in at least 11 Gulf Coast wells.

An average mud program calls for 16 to 19 pounds per gallon, low viscosity, low gel strength sea water muds.

Mud solids control is becoming increasingly important. Centrifuges and cyclones are used to provide suitable conditions for better mud chemistry. These separating devices are becoming standard equipment for lime treated mud systems. Quite a number of offshore operators are adopting the practice of drilling out below the intermediate string and then building up the mud gradually—tempering the walls of well as the hole is made.

Offshore operations stress the importance of staying out of trouble. Because of the supply problem and the limited mud inventory that can be carried on the drilling structure it is necessary to take the time needed to make sure that the mud is in the proper condition at all times and the proper precautions have been taken to eliminate blowouts and lost circulation. These troubles are doubly hazardous offshore due to the limited working area, the time that it would take to get the necessary relief equipment and materials to the well and, too, there is no running room in case of a blowout and fire.

## Precaution Against Blowouts Doubled

Blowout prevention precautions are practically doubled. On land a set of 900 series preventers might be used, whereas for a similar depth well offshore, three 1500 series are used. There is wide divergence of opinion on blowout preventer manifolding and little standardization. Additional preventers for the larger size casing must be on hand as well as the gas accumulator and manifold controls.

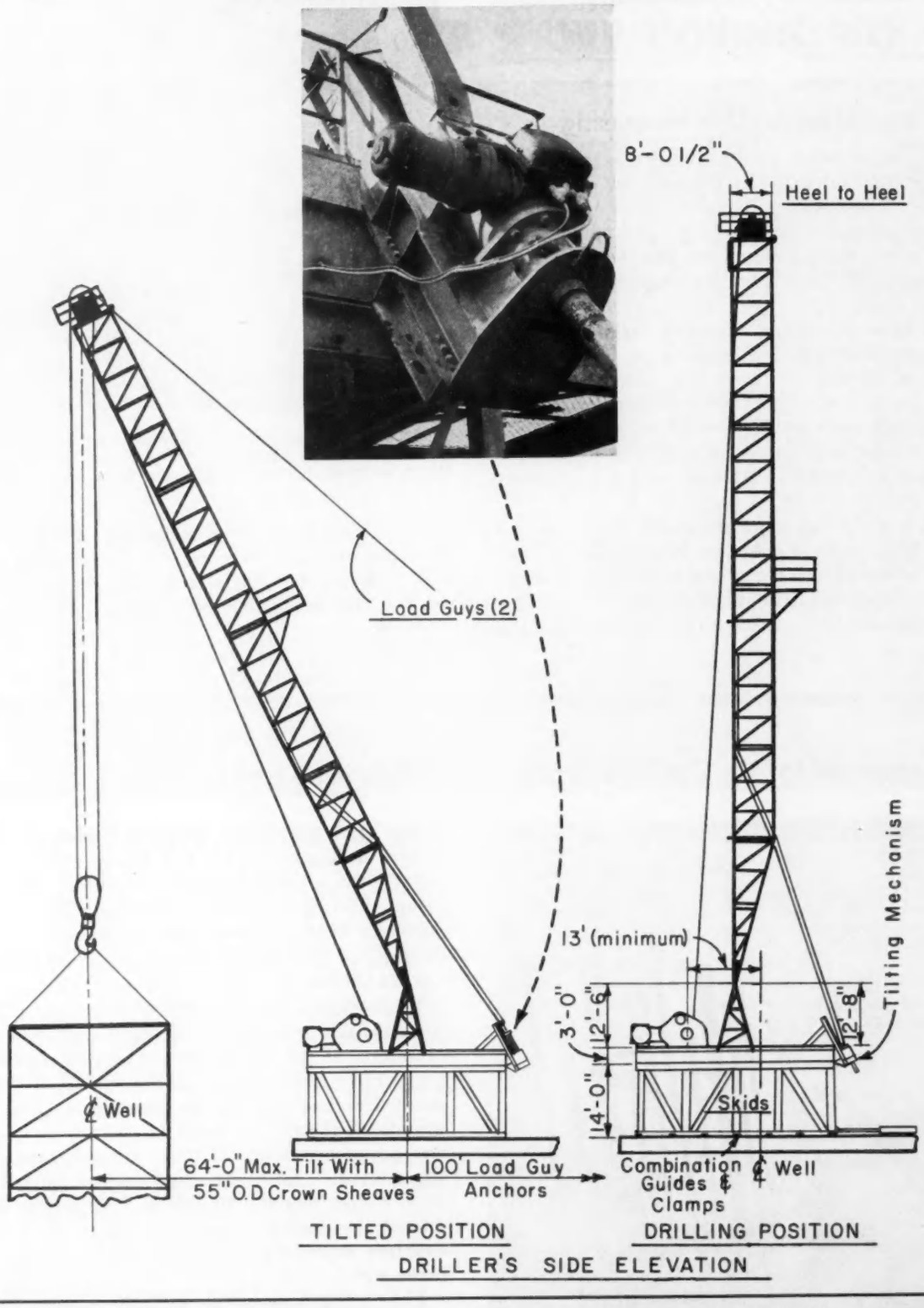
## What About Drilling Equipment?

As for the drilling equipment itself, 1000 horsepower pumps are becoming standard. Multiple well derricks are being used with crown blocks and rotary tables that can be positioned to drill six and more wells on 10-acre centers from one platform. Adjustable crown blocks and rotary tables also permit better positioning over the conductor pipe.

A mast that can be tilted out from the drilling platform is designed to handle a hook load of approximately 250,000 pounds for servicing the platform or for the installation of protection jackets or production platforms. Inset shows the motor and mechanism that tilts the mast out over the water.

Another important trend in offshore drilling to cut down the cost of operations has been incorporated in Mr. Gus II. The derrick is constructed with room for two sets of crown blocks. Two drawworks with one main power and two complete mud systems can be installed on this

**Drilling Mast Doubles as Construction Boom**




**ONE OF THE NEWEST FEATURES incorporated into an offshore rig is the tilting mast with a 30 foot base designed for winds up to 130 mph. Two guy lines powered from stiff leg cranes help tilt the mast after two motors (inset) have moved it off center. At 64 feet off-center the mast has a hook load of 250,000 pounds. Mast can pick the protecting jacket or one well platform off a barge and set it from this position. This is a time and equipment saving device especially when it would be impossible to get a derrick barge to site in rough weather.**

mobile barge so that two separate and complete operations can be carried on at one time.

For development drilling the idea of using one tender to service two platforms that are drilling side by side has already been put into effect.

These latter two features have the advantage of allowing the drilling of two wells at one time with a great reduction in the per well cost. It can readily be seen that during the greater part of a development program, this would offer a decided advantage.

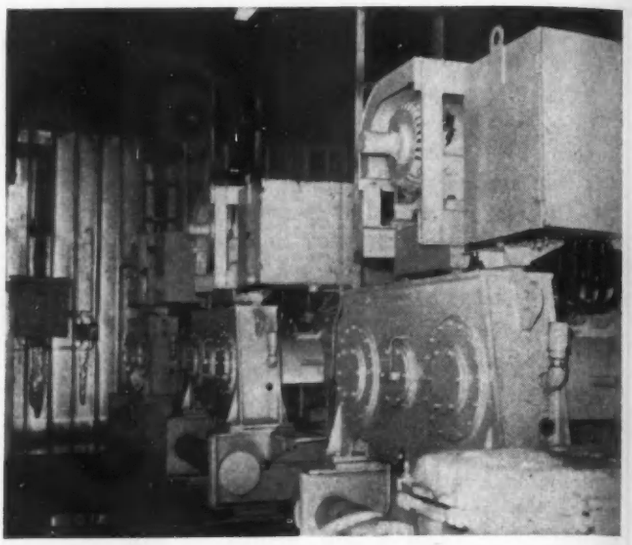
Special OFFSHORE REPORT

## Diesel-Electrics Use Increasing

Use of diesel-electric transmissions is gaining in offshore operations due to the flexibility of the arrangement of the component parts on the structure and the flexibility of power from this type of operation. This use of diesel-electric drives on tenders and below decks of mobile barges aids greatly in the proper utilization of every bit of space.

Over-all costs of drilling operations offshore are increasing daily. Large mobile rigs cost as high as $8500 per day from the day of release from the previous location until the time they are released after completing a well. They will average between $7500 and $8000 per day. Tenders cost in the neighborhood of $4000 to $6800 per day. Self-contained platforms cost approximately $3500.

Offshore is not the place for the novice to test his luck; the ante is high, and the stakes are even higher. Tremendous sums of money are being expended long before the well is even spudded. The latest techniques and most modern equipment are available to the operator, and mistakes are too costly to be tolerated. The success ratio has been exceptionally high and the rewards are apparently worth the gamble. Offshore drilling has matured into one of the most fascinating and challenging phases of the oil industry.



**USE OF DIESEL-ELECTRIC** transmission in offshore operations is increasing due to its flexibility in the placement of component parts of the power group. Kermac 47's battery of three 875 hp engines is shown.

## What happened to 'Mr. Gus' shows offshore drilling is no bed of roses . . .

Wide World Photo

**"MR. GUS" IS SHOWN** above tilted at an eight-degree angle shortly before it toppled over in 40 feet of water off Padre Island, Texas.

MR. GUS one of the first and largest of the offshore mobile drilling barges has had its share of glory and bad luck. Today it lies on its side in 40 feet of water off Padre Island. The $3½ million mobile unit had just finished drilling a 14,000-foot dry hole for Sun Oil Company, in State Block 974 located approximately 30 miles south of Corpus Christi.

While raising the hull section the weight of the entire structure is transferred to the eight legs, or spuds. Concentration of this weight on the smaller area of the legs apparently caused the legs on one side to sink deeper into the ocean floor causing the structure to tilt. The crew abandoned the rig on March 31 and a huge derrick barge was summoned from 25 miles away. While the derrick barge was tied to the structure a squall hit the area with 18 to 20-foot seas and 40 mile an hour winds. The anchor line on the derrick barge snapped and the huge drilling structure toppled into the sea, almost taking the derrick barge with it.

Here was a huge mobile drilling unit designed to withstand 125 mile an hour winds, but under an accumulation of rather odd circumstances was toppled by winds and waves of only one-third that magnitude.

Such are the hazards and risks of offshore operations. Mishaps such as this will make designers as well as contractors and operators re-evaluate their design criteria. It will assuredly cause an increase in insurance rates and eventually drilling rates. Salvage is possible but the cost will be tremendous.

# IMMEDIATE DELIVERY OF THIS COMPLETELY UNITIZED H-T OFF-SHORE CORING RIG

## BUILT FOR OFF-SHORE WORK - - NOT A MODIFIED SHORE RIG

Howard-Turner designed and manufactured all special ship-mounted equipment for the first experimental California off-shore coring and drilling boat in 1953. Included in this job was the following special equipment: Drawworks, gimbal-mounted Rotary Table, Swivel, Mast and Crown, Pump Arrangement, Mud Tank, Mixer, Shale Shaker, and Anchor Winches. The special design of this equipment allowed successful drilling from a rolling and pitching vessel in any depth of water. This special equipment was the forerunner of the present California fleet of floating platform drilling rigs. Despite the advances made since its first successful hole, this rig is still in competitive operation.

Howard-Turner has since supplied the special ship-mounted equipment for all of the West Coast mine sweeper class coring and drilling vessels and portions of this equipment on the larger vessels.

**DRAWWORKS FEATURES:**

Diesel engines, torque converter, Allison full load-quick shift transmission, two or three drum units, air clutches; unitized controls and instruments for controlling drawworks, rotary table mud and centrifugal pumps. This unit is specially arranged to compensate for the roll and pitch of the ship and to give close automatic weight control on the drill bit.

**ROTARY TABLE FEATURES:**

Unitized gimbal-mounted rotary table and drive. Special high gear ratio, light weight, small outside dimensions, 13½" API drive square with split removable taper section allowing a full 12½" opening when removed. The special gimbal mount keeps the rotary table level through all roll and pitch of the ship.

**SWIVEL FEATURES:**

Light weight, rugged, large opening with special gooseneck allowing coring through the swivel without making or breaking any connections.

**MAST AND CROWN FEATURES:**

Rugged light-weight tubular constructed mast, with unitized crown. The base of the mast is part of the drawwork and the rotary table support skid and the mast is removable.

**ANCHOR WINCH FEATURES:**

Special large line capacity, diesel-powered, torque converter, large brakes, high pull at low speed and high speed at low pull. Arranged so that the engine is used for the auxiliary pump drive when on location.

**PUMP ARRANGEMENT FEATURES:**

Diesel engine, torque converter, drive arranged for the use of a mud pump and centrifugal pump either individually or at the same time as required by the operation.

**MUD TANK, MIXER AND SHALE SHAKER FEATURES:**

Special light-weight tank with built-in mud hopper conveyor and mixer, special light-weight dual shaker—each side 24" x 48" allowing selection of either or both sides as conditions require.

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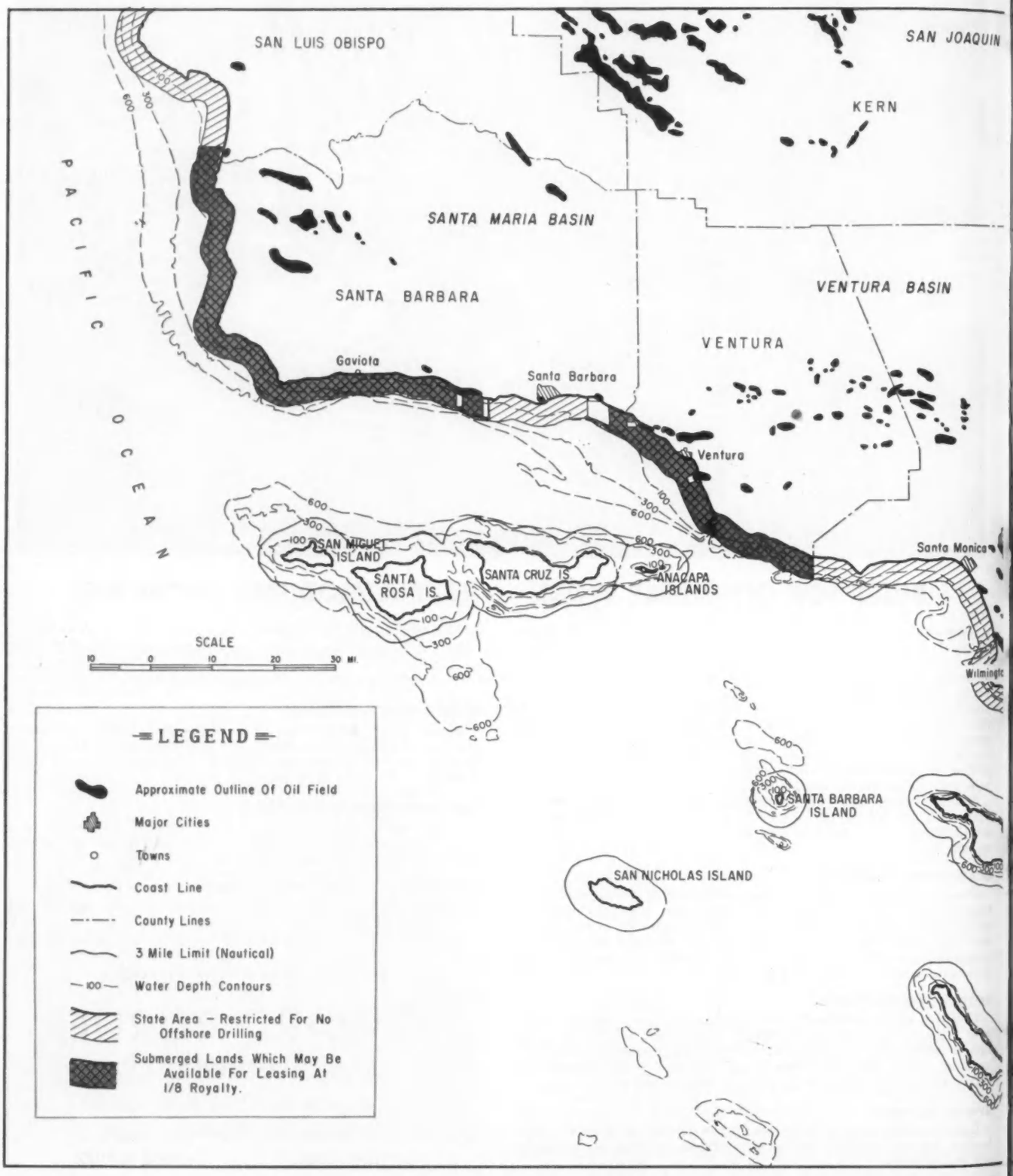
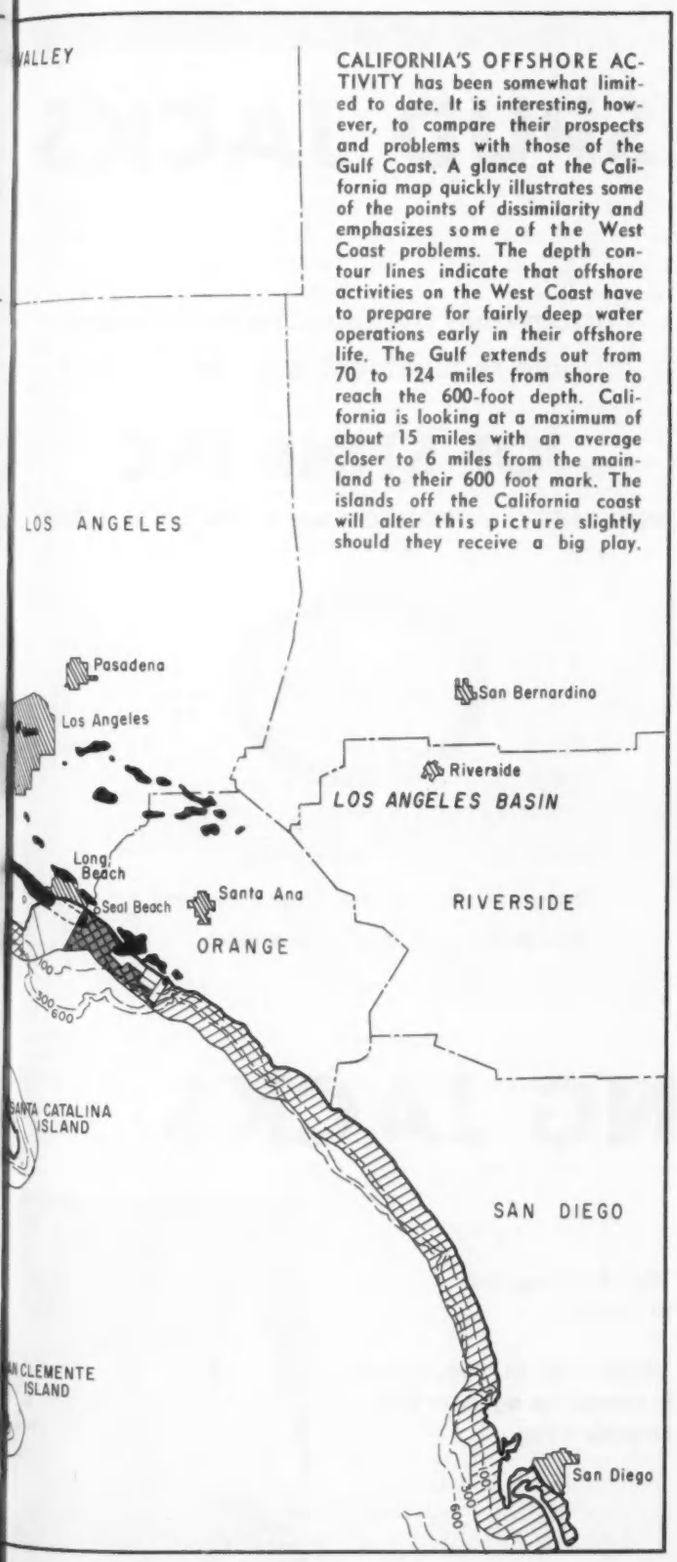
# Production Practices . . . costs




**For more about California offshore production practices. . .**

## *hold key to the many production problems facing offshore operators*




CALIFORNIA'S OFFSHORE ACTIVITY has been somewhat limited to date. It is interesting, however, to compare their prospects and problems with those of the Gulf Coast. A glance at the California map quickly illustrates some of the points of dissimilarity and emphasizes some of the West Coast problems. The depth contour lines indicate that offshore activities on the West Coast have to prepare for fairly deep water operations early in their offshore life. The Gulf extends out from 70 to 124 miles from shore to reach the 600-foot depth. California is looking at a maximum of about 15 miles with an average closer to 6 miles from the mainland to their 600 foot mark. The islands off the California coast will alter this picture slightly should they receive a big play.

**...turn to Page 148**

HAZARDOUS CONDITIONS, remote difficult-to-reach locations, plus extremely high exploration, drilling, development and operating costs, necessitate close scrutiny of offshore production practices and installations. To survive economically, offshore production must be handled efficiently and without constant physical supervision.

Because manual supervision of conventional lease equipment requires expensive offshore transportation facilities, which the weather may interrupt at any time, much thought has been given to unsupervised automatic control. Several offshore Louisiana fields are being operated with automatic systems. Some have operated successfully for more than six years.

Automatic production systems have their largest applications in areas where production of sufficient quantity exists. Automatic devices cut transportation costs, reduce dependence on good weather for operation, eliminate the need for extensive storage facilities offshore.

Storm chokes are standard equipment on offshore wells. These will shut-in the well under adverse conditions. Sand control equipment and other down-hole devices are rather common, and are often installed during initial completion to avoid recalling a rig.

All operators are keeping careful records on pressure decline. However, it is too early in most cases to establish a definite trend. Much of the Louisiana offshore production is coming from deep-seated domes and shallow domes where faulting is resulting in water encroachment along the faults produced by pressure differential accompanying production. Under such circumstances rapid initial declines are not particularly indicative since they can level out at any time during the early life of the reservoir.

Although it is still early in the game, repressuring programs are an important consideration. The highly permeable reservoirs indicate that pressure maintenance could be very effective. Late this year or early next year, two companies that have unitized their activity expect to start a fair sized water injection repressuring project.

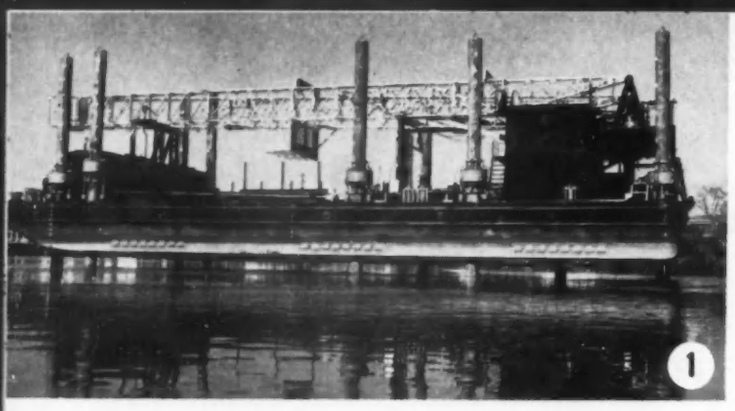
### Well Completions Under Water?

Nearly everyone has suggestions on improving offshore operations. One of the items frequently discussed is completions—especially underwater completions. Designs for such operations range widely. It may never become common practice to complete wells underwater, but don't be surprised if it happens soon.

As far as general practices are concerned, completions are carried out much the same offshore as they are onshore. However, first class equipment is used in all cases since the few additional dollars spent for Grade A material is a small percentage of the over-all cost.

Dual completions are a fairly frequent occurrence and triple completions are getting consideration in numerous areas.

Permanent completion procedure has not had much



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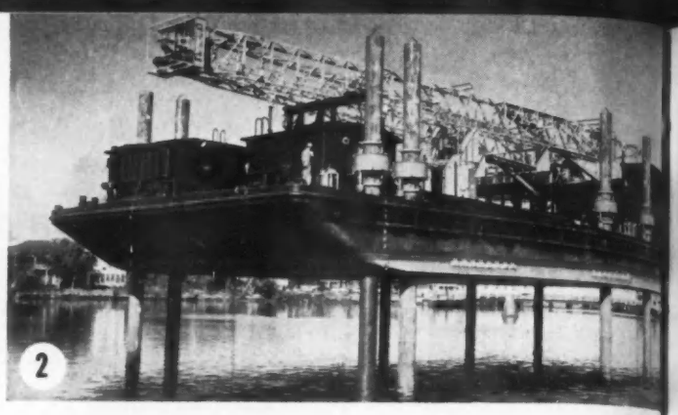

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# BIG BARGE . . . SPUD JACKS

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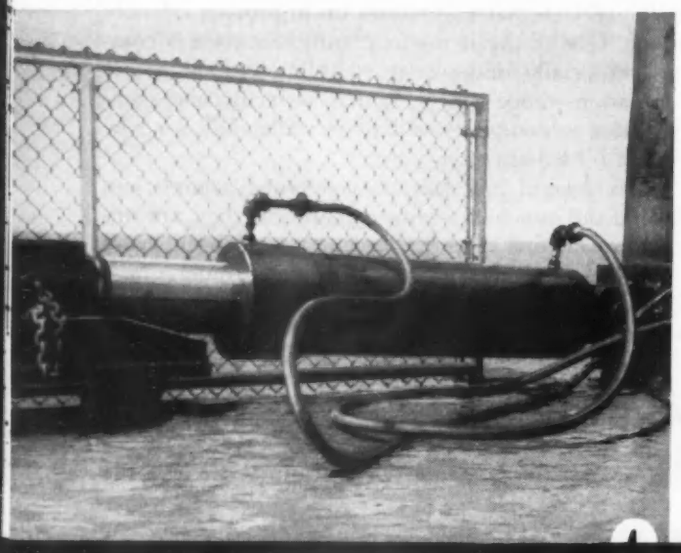
1. **Spud jacks begin to operate.**
2. **Barge can be raised to any desired height.**
3. **This unit has 4 ft. piston stroke.**

# RIG SKIDDING JACKS



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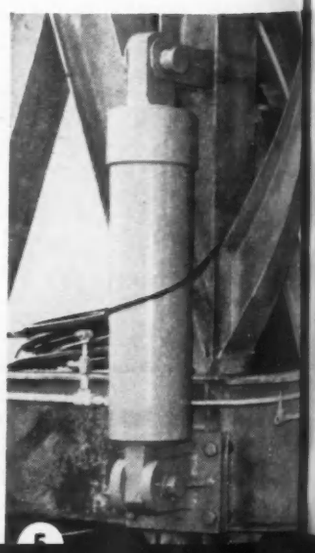
4. **Rig skidding jack at work.**
5. **When not in use, jack is swung up against sub-structure leg.**

•

**WRITE FOR OUR NEW CATALOG**



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acceptance offshore as yet. There is some feeling that its application is limited and at present there is little difficulty in obtaining conventional workover rigs.

## Workovers vs. Economics

The next two or three years, however, may tell a different story. Operators are now being faced with the problem of making their offshore ventures pay. Development drilling is already receiving greater emphasis. By 1960 there may be approximately 2600 offshore producing wells in the Gulf.

Today, if one well on a platform of six needs to be worked over, the operator will probably wait until three or four require treatment before calling out a workover rig. This is necessary to warrant the cost of the rig. With emphasis on production, however, the operator can hardly afford to deprive himself of thousands of barrels of oil while waiting for additional wells to sand up. This should cause some additional activity in search of a solution to the workover problem.

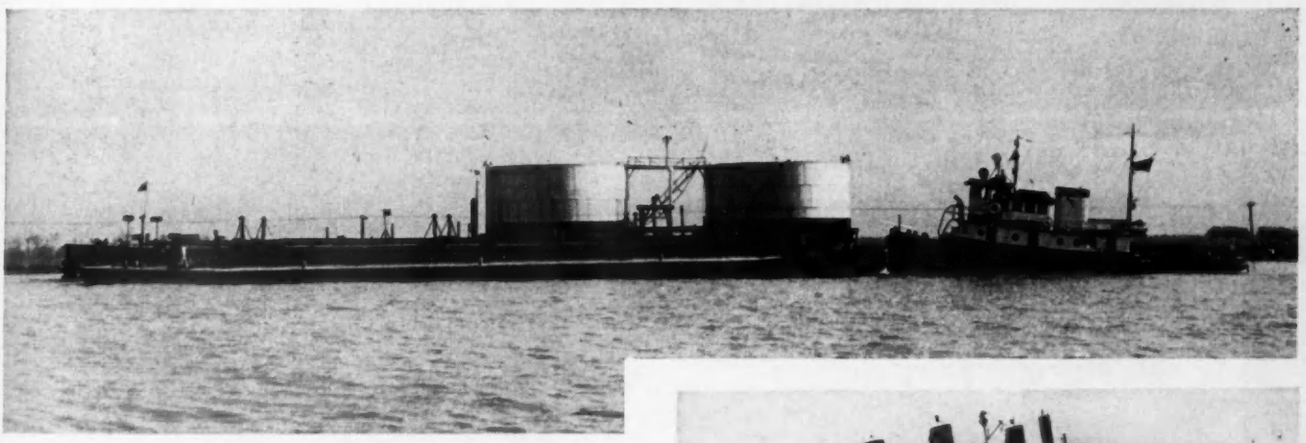
Currently, permanent completion appears the most practical and least expensive possibility that has been tried commercially. Offshore permanent completion perforating is not new and units built specifically for offshore operation are on the market now. A lack of adequately trained crews has been a major drawback to these operations to date. This situation is lessening daily and the dollars and cents difference for comparable work will be difficult to overlook.

## Transportation the Big Problem

The major problem confronting production men offshore is not well equipment or workovers. The big question is "where will we put it after we get it?"

Answers to this question depend on a number of variables. How much production is there? How far offshore is it? How close are surrounding wells? These and other factors have been responsible for a number of different schemes, each with its strength and weakness.

Barging is the first logical step when quantities are small. It's an expensive means of transport, adding 40 cents a barrel or more to production costs, depending primarily on the distances involved. One company tried to solve its storage and transport problem in a single stroke. They hooked a barge to a buoy near the well and pumped the oil directly into the barge. When one barge filled, another replaced it. But when weather is bad, the barges cannot operate. This creates more problems.



**TRANSPORT AND STORAGE of production are vital parts of offshore operations. Storage tanks all shapes and sizes are used along Gulf Coast to collect offshore oil brought in by pipe line and barge.**

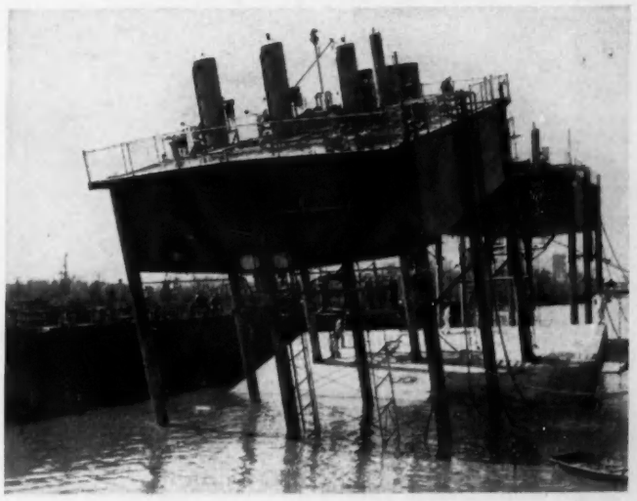
## Offshore Storage Expensive

There are any number of schemes for the storage of crude offshore and all are expensive.

Tanks of almost any capacity can be placed well above water level on steel islands. Often the drilling platform is converted for this task with separators etc. all included. There is under development a tubular tank of rugged tire carcass construction in sizes up to 2500 gallons which should be available before the end of 1957. To some operators they look very good.

Tank-battery barges of various sizes are being floated to locations, sunk and then pinned in place with a relatively new and efficient pile to jacket connecting device. The storage space on these barges may be on the floor of the Gulf or well above the water level, whichever design the operator desires.

If tanks of sufficient capacity can be located offshore in



**THE MOBILE, submersible tank-battery barges, undergoing test here provide storage facilities on shallow water locations in the Gulf. At present there are about 12 of these units in service in water up to 20 feet deep. Capacities range from 2000 to 10,000 barrels. They can be raised and lowered without much difficulty or special equipment. Positive lateral stability is assured by ground control once the unit is submerged.**

*These foremost offshore drilling contractors and companies use CONTINENTAL-EMSCO drilling rigs and equipment:*

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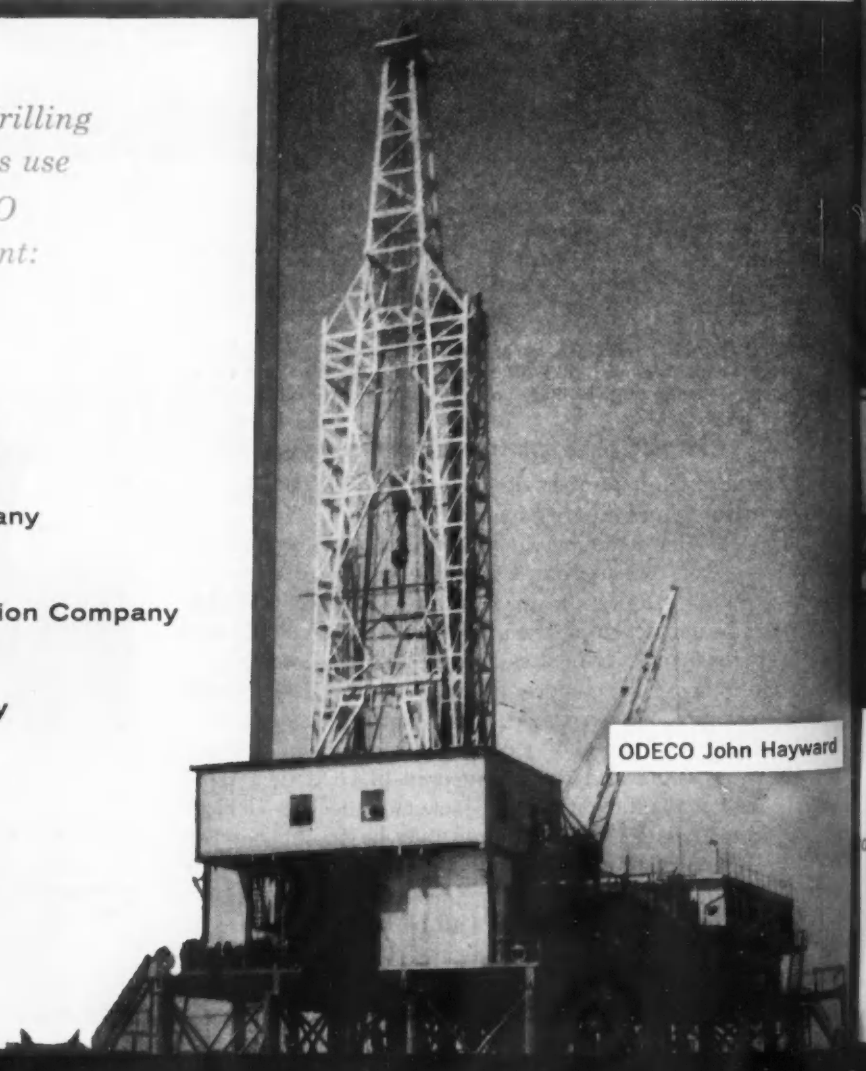

# SALUTES OFFSHORE DRILLING

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*Check these outstanding Series "E" Drawworks Features*

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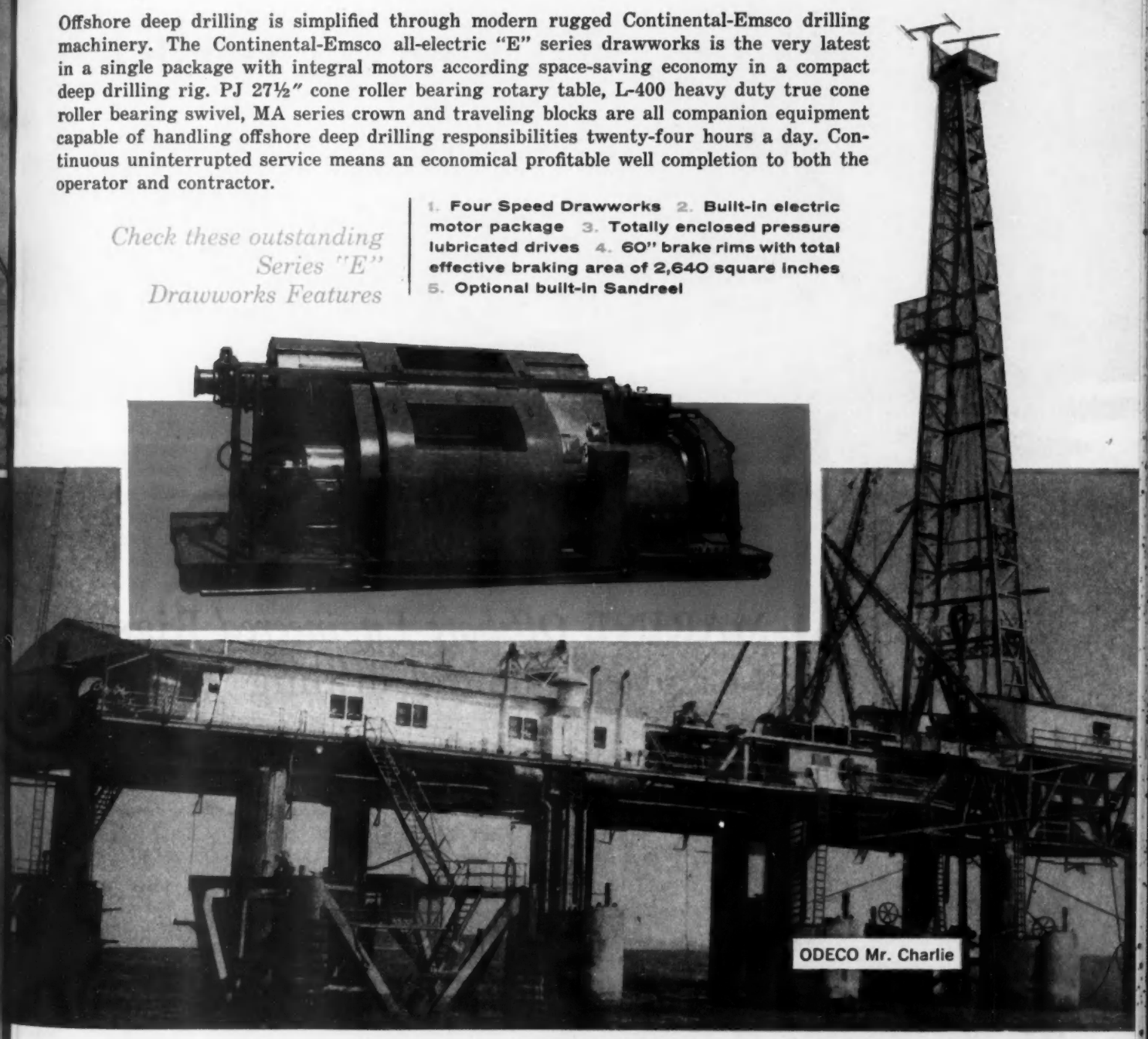


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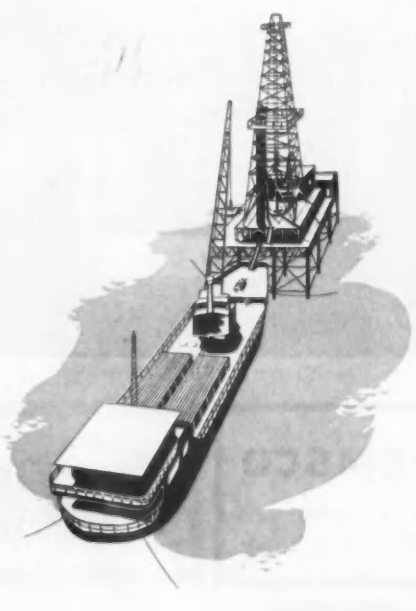
# COASTAL-MARINE *Offshore Engineered* Rigs guarantee fast and economical drilling



Specialized equipment is the answer to offshore drilling problems . . . and Coastal-Marine's original designs insure high drilling rates and continuous operations in every marine location. For example, in medium depth drilling and workover operations, the Coastal-Marine unit pictured offers fast operation, mobility, and high capacity. With electric power throughout and unusually large deck pipe rack capacity, it offers maximum flexibility for safety and economy in bay and inland water drilling.

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the vicinity of the wells, tankers could load right at the field and be on their way. This would reduce handling costs but would necessitate storage facilities capable of accommodating 50,000 to 200,000 barrels. It is easy to see that it would take a lot of barrels of oil to pay for building that amount of storage, especially in 100 or 200 feet of water.

A rough idea of the expense can be gained from the relatively small project. A 70-foot by 140-foot platform in 60 feet of water was estimated to one offshore operator at $650,000. The two 10,000-barrel, galvanized, bolted tanks installed on the platform cost roughly $17,000 each. This would look much like buying a $165,000 set for a $34,000 diamond but offshore activity can't always be judged by onshore standards. The ultimate answer is pipe lines if and when the production warrants it.

## Production Platforms Vary

The same variation exists in production platform design as is apparent in storage facilities. Each problem is attacked by each operator in a different manner. Material shortages caused innovations in design for a time but that situation no longer exists.

This kaleidoscopic design picture has caused anguish among some service companies, workover rig operators and others until the suggestion has been made that the offshore concerns pool their engineering data and arrive at some standards for production platforms. This might prove beneficial for all concerned and could do much to cut operating costs. There are several gaps that would have to be bridged in individual thinking, but there are sufficient data available and there is enough involved to warrant the effort toward such standardization.

Leaving drilling platforms on locations to serve solely for workover accommodation has been questioned by more than one operator because of the investment. If the value of that portion of the structure left after drilling averages half a million dollars, huge sums can soon become tied up. No doubt the future will see some progress made in economizing this factor.

There are other difficulties connected with large production platforms. All offshore structures are required to have lights and a fog horn. The moment a drilling barge leaves a producing wildcat a derrick barge must be standing by to set the platform, fog horn etc. The difficulty in timing the activities of two such large pieces of equipment usually ends in considerable standby time for one or the other unit. At from $8000 to $12,000 a day it does not take long to run up a sizeable bill.

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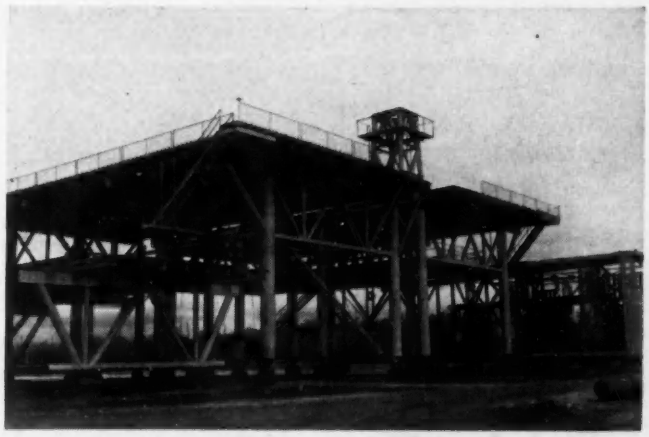
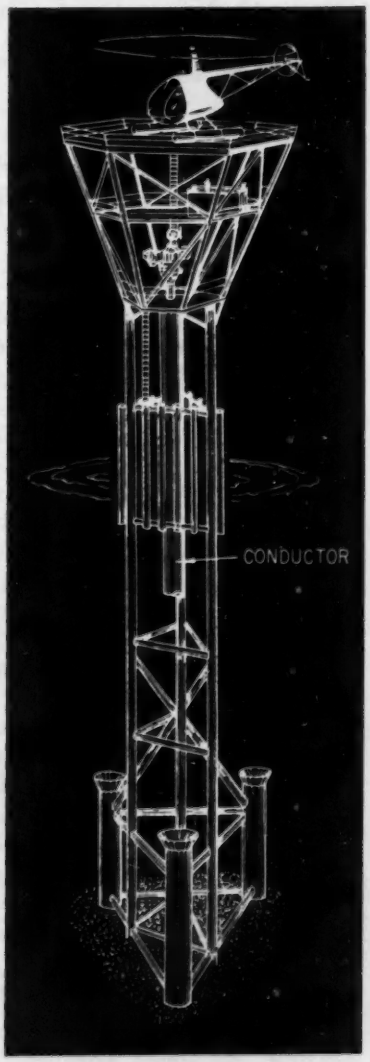
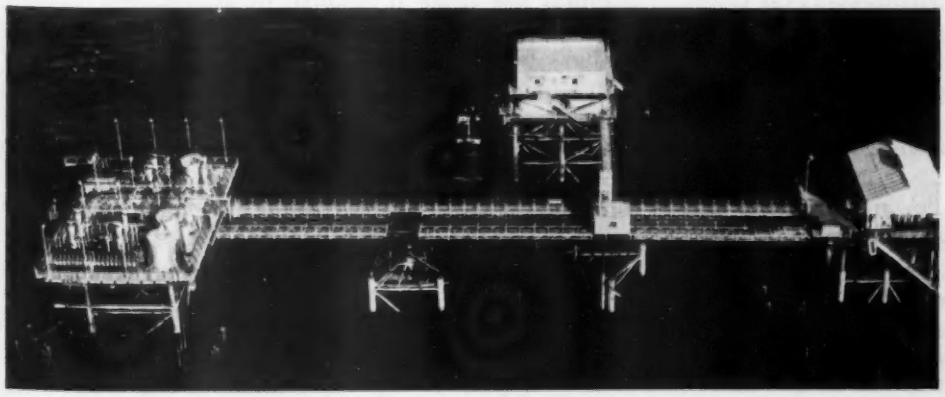


**OFFSHORE PLATFORMS** (top) are stored near the water's edge after construction waiting the call that will send them seaward. All types, shapes and sizes are lined up ready for use. The years 1957-1960 will see more of these than ever before take their place in the man-made archipelago off the Gulf Coast.

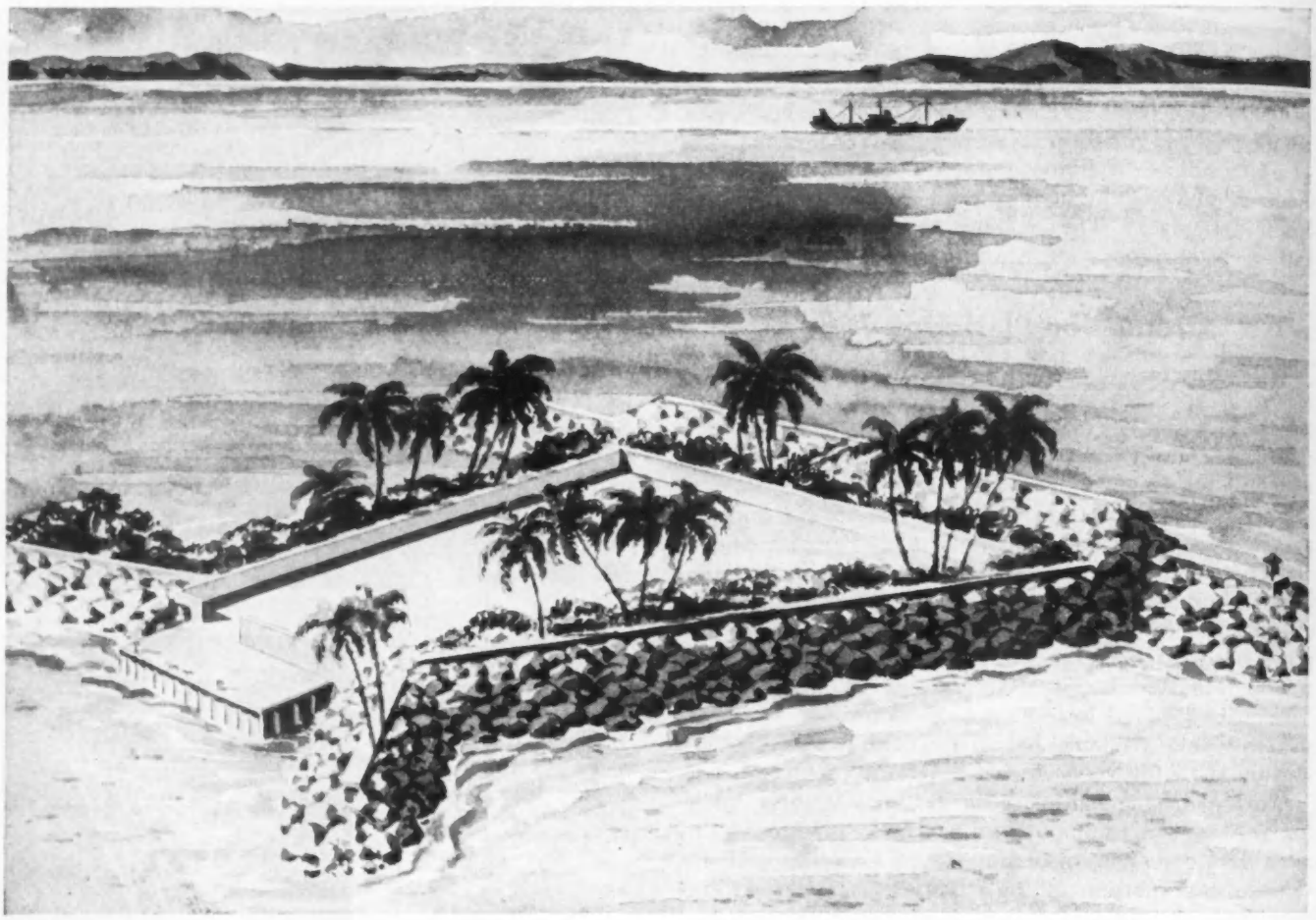



**THIS SUGGESTED** three-pile protective tower (right) is similar in design to structures now in use in the Gulf. It is for use in 90 feet of water and includes a heliport which makes the well accessible even in rough weather.



**OFFSHORE PRODUCTION** platforms must be engineered to use every square foot of space. Safety features are incorporated that assure maximum protection for personnel and property. The standby boat is almost as much a part of this structure as the piling. Production equipment on the left platform handles the crude of several nearby wells. Housing facilities are located on the center platform. On the right are the pumps and compressors that will send the oil and gas through pipe lines to shore.

Special OFFSHORE REPORT



**CALIFORNIA OFFSHORE OPERATORS** are confronted with a unique regulation restricting the use of structures which mar the beach scenery. This artist's conception of an island now under construction shows how they plan to handle the situation. The island is one half mile offshore in 41 feet of water. Its surface is 24 feet above the water level and will eventually accommodate an estimated 70 wells.

## California's Offshore Picture

THE ONLY PRODUCING wells so far completed in California waters are those drilled by Monterey-Texas Company on its filled island some 1½ miles offshore from Seal Beach.

Of the 20 wells so far completed on the island, 18 are producing from a lower zone at total depth of around 6000 feet, and two are producing from a shallow zone at 3900 feet.

At present all the wells are still flowing except for one or two that are on gas lift. Tentative plans have been made for pumping the wells with bottom-hole hydraulic pumps, but from present indications pumping will not be necessary for some time yet. Currently, wells are being drilled and completed at the rate of about one per month.

Some workover has been done in one or two wells but it involved only the skidding of the rig and proceeding with the work in conventional manner.

Except for the necessarily compact grouping of casing heads, with some 70 wells ultimately to be drilled from this 75-foot diameter island, completions are similar to conventional onland practices. Double-decking of the platform has made it possible to increase the ultimate number of wells that could be drilled in the limited space available.

Production from all wells, except those under test, is sent ashore through an 8⅝-inch line to onshore trap and tank farm facilities near Seal Beach. Individual wells can be tested by putting them through one of the three 3-inch lines included in the "bundle" of pipe lines that was laid in a submarine trench between the island and shore facilities.

Safety features of the island, in addition to conventional fire-fighting facilities, include a "sniffer" system which extends to all cellars. The commercially-available device samples, in sequence, the air from each cellar. Should gas be detected in any cellar; the unit stops, thus indicating the cellar in question, a warning horn blows and a red light flashes on to attract attention. For added protection all cellars are equipped with foam-type fire extinguisher spray heads. —**The End**

FIGURE 1—Index map showing Sinu Basin and adjoining areas.

# Sinu Basin in Colombia May Produce New Reserves

**Previous drilling shows evidence of commercial production in the Floresanto anticline. Here's a review of geology of the area.**

**By VICTOR OPPENHEIM**
Dallas

THE COLOMBIAN SINU BASIN lies between the Sierra de San Jeronimo and the Caribbean coast in the northwestern part of the country. The valley of Rio Sinu traversing the basin is about 150 miles long, while the basin proper between the San Jeronimo Range and the coast is about 50 miles wide. Elevation of the area varies from about 200 to about 1500 feet. Hilly ranges running parallel to the Valley in a north-east to south-west direction are characteristic of the basin.

Geologically the basin is made up of a great thickness of successively superposed sediments ranging in age from Cretaceous to Pliocene; Miocene and Oligocene beds predominate and are exposed in wide areas. The formations are of marine sedimentation and are fossiliferous. The faunas were described in several papers. The total thickness of the sedimentary beds in the basin may reach 20,000 feet.

Structurally the hilly ranges that traverse the basin represent extensive anticlinal folds. These are frequently faulted and sometimes thrusted. The basin is also traversed by numerous normal faults. These follow the general structural trend.

Numerous oil seeps, gas seeps and mud volcanoes observed in the basin indicate obvious presence of substantial oil accumulations. Lack of adequate exploratory wells has kept the petroleum development of the basin far behind its potentialities.

The Rio Sinu Basin (Figure 1) was studied by the writer on several occasions between 1947 and 1952. Numerous field trips and supervision of exploratory borings for oil on the Floresanto Petroleum Concession, west of the Rio Sinu, offered ample opportunities for geological surface and sub-surface observations. The core and electric logs of various borings drilled in the Floresanto area by the Sinu Oil Company were perused freely with due authorization of the Ministry of Mines and Petroleum of Colombia, which made them available for the development of the Floresanto Concession.

The first systematic geological work in the region was done by the geologists of the Sinu Oil Company (Socony-Vacuum and International Petroleum Company) and all the names of geological formations were first applied by these companies. For the

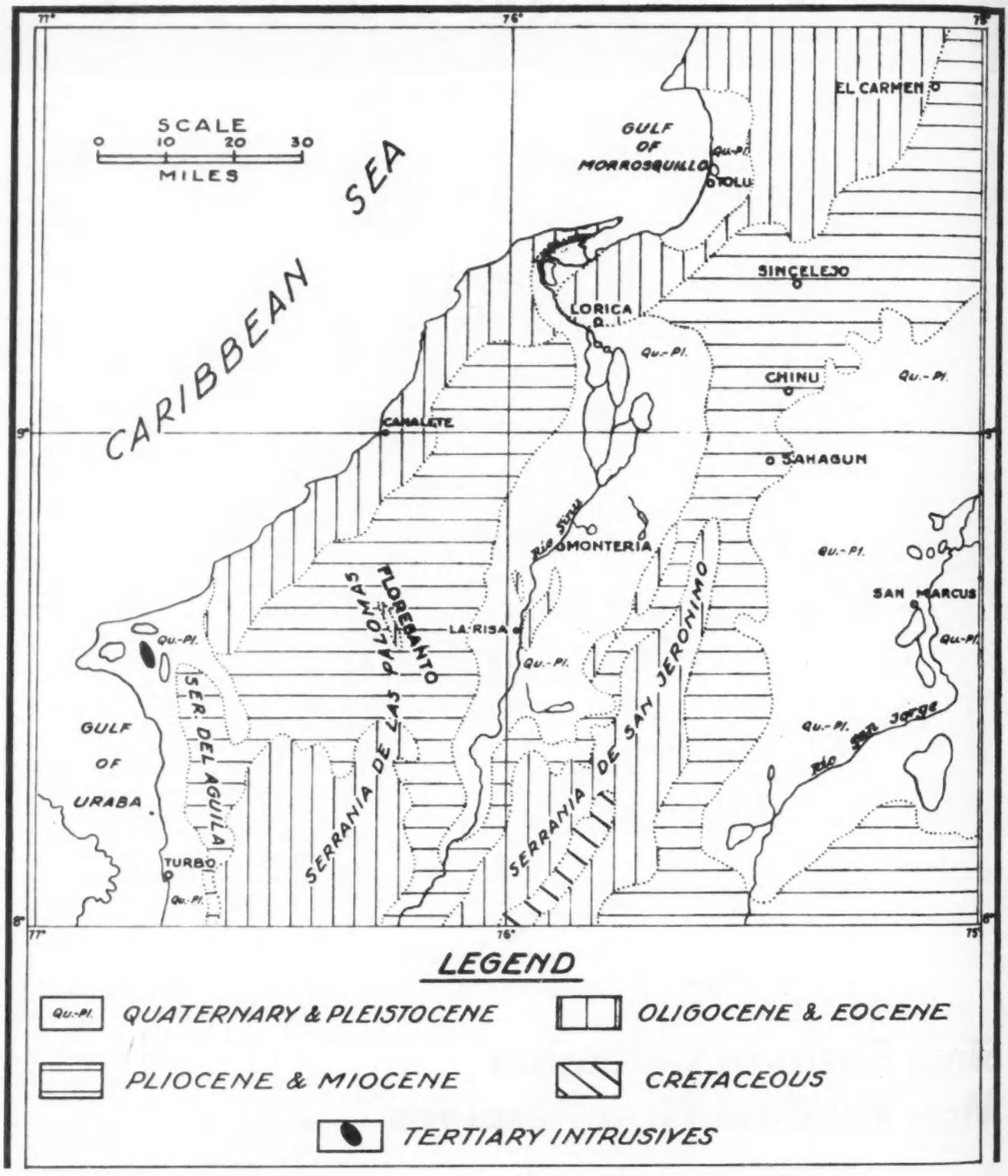



FIGURE 2—Geological map of the Rio Sinu Basin.

perusal of numerous drilling logs and other pertinent data, particularly on the Floresanto area in the Sinu Basin, the writer is indebted to the Colombian government.

**Geology.** The Tertiary sedimentary section appears well developed in the Sinu Basin (Figure 2). The total thickness of the sedimentary cover in the basin may reach 20,000 feet, however, as no wells were drilled in the basin, most of the data refer to surface outcrops and their relation and position in the stratigraphic section. (Figure 3).

• **Pliocene**—The Pliocene appears as a loose conglomeratic formation, interbedded with rather loose sandstones and clays or sandy clays. The conglomerates are mostly of white quartz and sandstone pebbles. The total thickness of the Pliocene is about 500 feet in the Quebrada Cachaco, tributary of Rio Jaraguay.

• **Upper and Middle Miocene**—Typical outcrops appear in the Rio Jaraguay, western tributary to Rio Sinu, where they consist mostly of

massive gray-blue clays and clay shales with a few interbedded sandy stringers. Upon weathering the outcrops appear reddish. Stratification of these beds is uncertain or lacking. The thickness can be estimated to be of the order of 3000 feet. The age is determined by the position above the fossiliferous, conformable Pajuil formation, and consequently the age of these sediments should be Middle Miocene, grading upwards into Upper Miocene.

• **Lower Miocene**—These sediments constitute the Pajuil formation consisting of gray-blue shales, interbedded with sandstones and sandy shales. Marly clay-shales, limestone layers and concretions are also frequent in the section. The shales carry abundant mega-fossils which permit a positive age determination of the sediments. Exposed sections of the Pajuil formation can be found in the Sierra de las Palomas. The thickness of the formation is about 6000 feet, and can be measured in the creeks at the foot of the Sierra de las Palomas.

• **Upper Oligocene**—Underlying the Miocene, there appears in the Quebrada Floresanto and in the Floresanto anticline west of the Sinu Valley, a series of well bedded shales and sandstones of a mauve, reddish and gray color. The total thickness of these beds is of the order of 4500 feet. The age of this Floresanto formation has been variously placed by the Sinu Oil Company geologists into Lower Miocene and finally into Upper Oligocene. It seems to the writer to be undoubtedly underlying the Miocene and thus it must be of Oligocene age. Several substantial sandstone layers in the formation make conspicuous outcrops in the area. Oil-bearing sandstone beds of the Floresanto formation were found in the various shallow borings of the region. These measured individually about 30 to 100 feet in thickness.

• **Middle Oligocene**—East of the Rio Sinu, there are numerous outcrops of a light colored, massive, coarse to medium grained sandstone named by the Sinu Oil Company geologists, the Charrura formation. A fossiliferous layer in its upper part makes its age determination positive. Several shaly beds are associated with the formation, however, it appears to be composed essentially of coarse loosely cemented sandstones. The

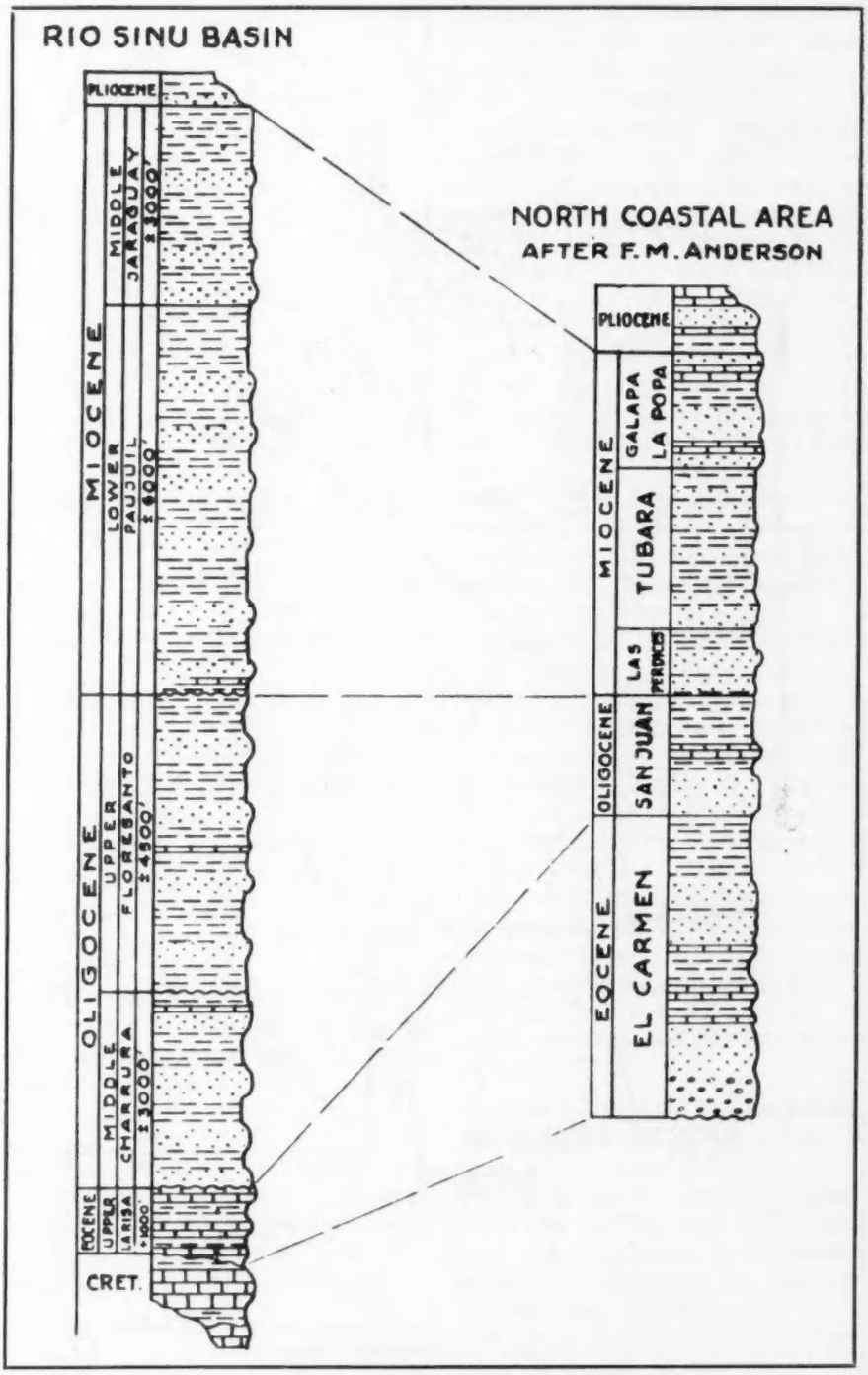



FIGURE 3—Columnar Sections – Northern Colombia, S. A.

Charrura formation outcrops mainly in the Sinu Valley but should underlie the Floresanto formation. The thickness of the Charrura formation can be estimated at 1500 feet, however, its total thickness east of the Rio Sinu, as measured by the Sinu Oil Company geologists may be double.

• **Upper Eocene**—The Upper Eocene beds are known as La Risa formation by the locality of the same name, and occur in extensive outcrops along the eastern bank of the Rio Sinu, forming the Sierra de San Jeronimo. They also form conspicuous outcrops on the road to Guineo, at the place called La Risa. The upper part of the formation consists of white to yellowish limestones underlain by reddish sandstones and shale. The limestones are very fossiliferous. The shales in some outcrops appear dark and bear a considerable foraminiferal fauna. The upper part of the formation was measured to be about 1000 feet. Its total thickness is not known—it may grade into Cre-

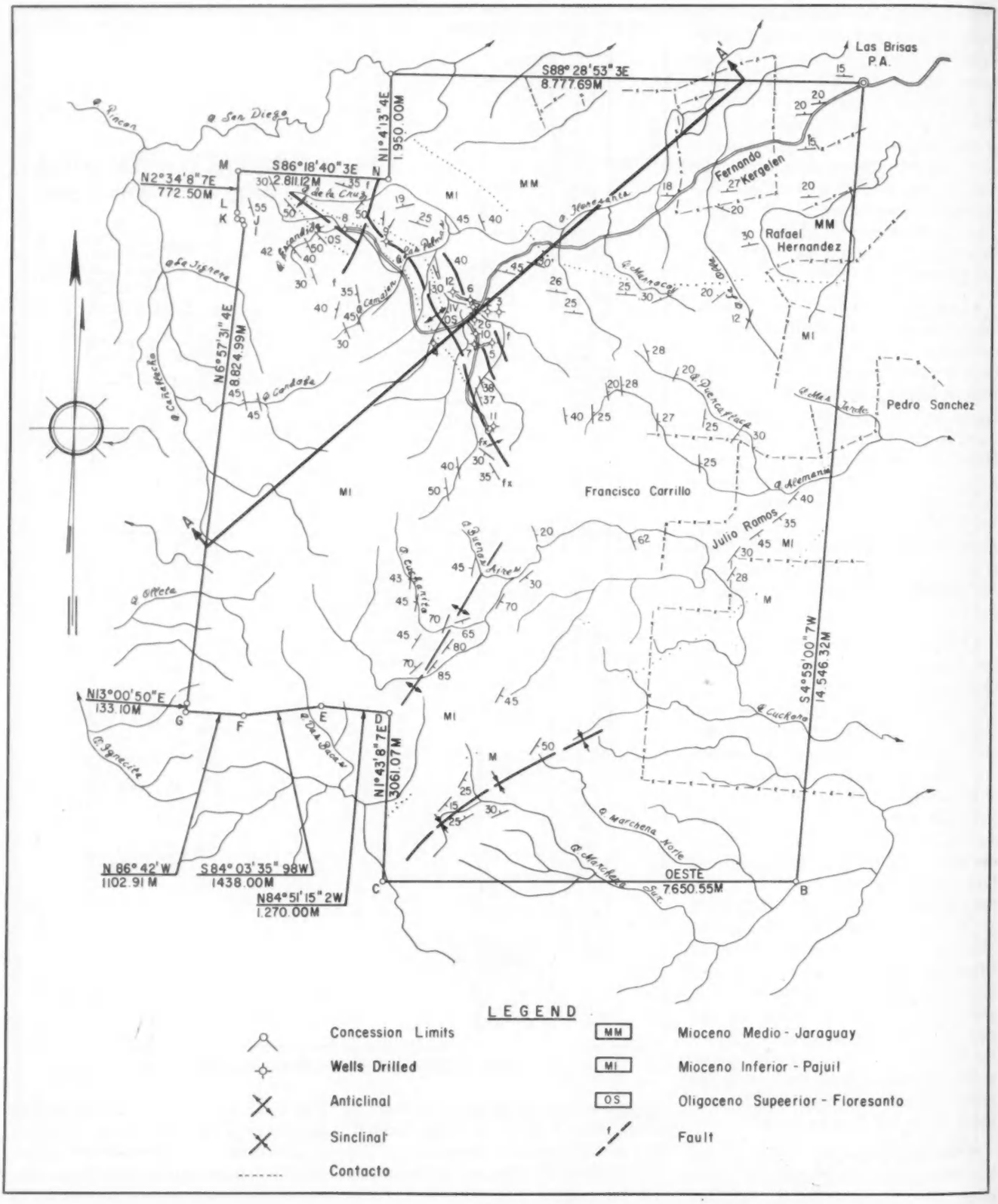



FIGURE 4—Topographic map of the Floresanto Concession.

taceous. The La Risa underlies unconformably to the Oligocene beds.

• **Cretaceous**—The geological map of South America of the G.S.A. published in 1950 shows the whole San Jeronimo range, as of Cretaceous age.

**Tectonics.** The main structural trends of the region are directed from southwest to northeast. Secondary cross-trends from southeast to northwest are also present. Thus, two diastrophic cycles have affected the area, and along these structural lines the folding and faulting of the basin took place.

The area best studied in the basin is the Floresanto area. The Floresanto anticline is about seven miles long and one and a half miles wide, as it appears on the surface. It is folded in the Floresanto and Pajuil formations and is evidently faulted and

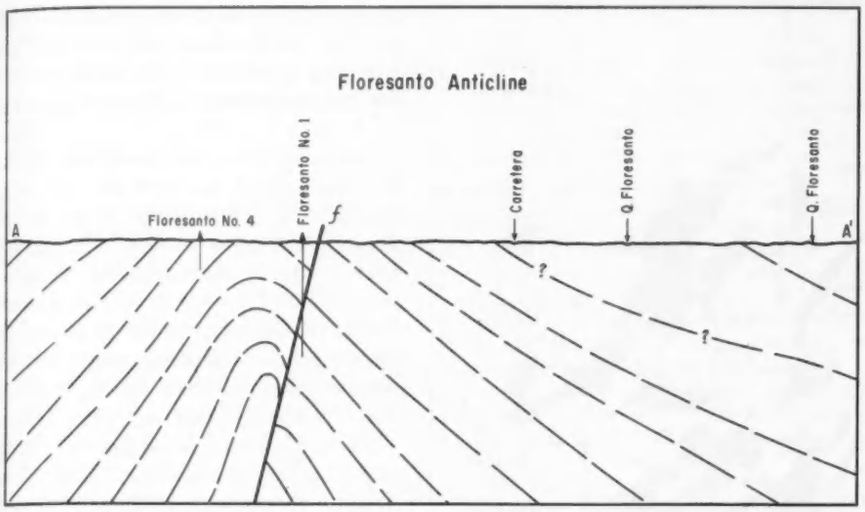



FIGURE 5—Cross-section of the Floresanto anticline.

thrusted along its eastern flank. Thus, it is a complex structure, and not a simple symmetrical anticline as originally interpreted by the Sinu Oil Company geologists. The axial zone of this anticline should be looked for in the area west of its surface axis—it positively could not correspond with the surface axis of the anticline. The deep test drilled in 1947 by the Sinu Oil Company, Floresanto 10, would indicate a thrust fault to the east, however, the lack of any other adequate deep borings in the region does not permit any correlations of this well. It simply proved that this well was located in a fault zone.

Another steep anticline appears in the southwestern part of the area, affecting the southeastern extremity of the Floresanto structure. At the intersection of these two folds a structural up-doming could be expected, however, not enough is known of this feature. It may represent an important structural oil trap.

Without describing the many surface structures of the basin, a large fault running parallel to the Sinu River must here be mentioned. This fault is partly thrusted and outlined by several large oil seeps at La Risa.

It is the writer's belief that the past attempts of seismic work in the area, as well as all of the shallow wells to date in the Floresanto area, have all been equally inadequate and unfruitful in outlining the true potentialities of the Floresanto structures.

**Oil Seeps.** Oil seeps and oil and gas manifestations are numerous in the Sinu region. Oil has been used for lighting by the natives of Floresanto since very remote times. Some of the principal, but by far not all, of the known oil seeps in the area are as follows:

- **Matamorros Creek**—Several active oil seeps and oil saturated sands appear in this creek some five miles southwest of Floresanto. Natives here still gather and use oil from the seeps for domestic purposes.
- **La Risa**—About ten miles northeast of Floresanto several active oil and gas seeps appear in the La Risa fault in Eocene beds.
- **Coastal Area**—Several oil seeps and numerous mud volcanoes appear west and northwest of the Sierra de las Palomas and northwest of Floresanto.

**Former Exploratory Wells.** Although most of the Sinu basin is at present covered by petroleum concessions, the only significant wells were drilled by the Sinu Oil Company in the Floresanto area some 10 years ago. The few shallow wells drilled during and after this company's operations were totally inadequate. Of the 10 shallow wells drilled by the Sinu Oil Company, to about 1500 feet, most were centered in the southeastern part of the Floresanto anticline. Almost all had good shows of oil and/or gas, and two wells, Floresanto 1 and Floresanto 6, produced about 13,000 barrels of 51 API paraffin base oil which came in flowing at the rate of about 50 to 70 barrels per day. The electric logs and drilling logs of the shallow wells give evidence of their characteristics.

Of the two deep wells, Number 1 was drilled to 6936 feet and was completed as a shallow producer in December, 1945. It was flowing 62 barrels per day from 614 to 696 feet. Number 10 was drilled to 10,876 feet and was abandoned because of an unsuccessful fishing job. It was intended to reach the Charrura formation but was inadequately located on a fault plane and in a zone of fracturing. Thus, the results of the boring were negative, as it traversed steep and broken beds.

The work done in the area since the departure of the Sinu Oil Company in 1947 has not been carried out with equipment adequate to test the structure, and consequently, has not added to the geological information of the area.

**Conclusions and Recommendations.** The study of the surface geology of the Sinu basin and of the Floresanto area in particular, as well as of the drilling logs and electric logs made available in the Colombian government files, lead the writer to the following conclusions:

- The only deep well in the Floresanto area and in the whole Sinu basin is Floresanto 10 which was located in a fault zone and thus, did not reach the Middle Oligocene, Charrura formation for which it was intended.
- The shallow wells drilled with portable equipment proved the presence of important oil accumulations in the Floresanto anticline. They were centered, however, in a limited eastern part of the structure. The western and southern parts of the anticline were left untested, as well as the Pajuil formation east of the structure.
- Thorough geophysical studies and

*Continued on Page 162*

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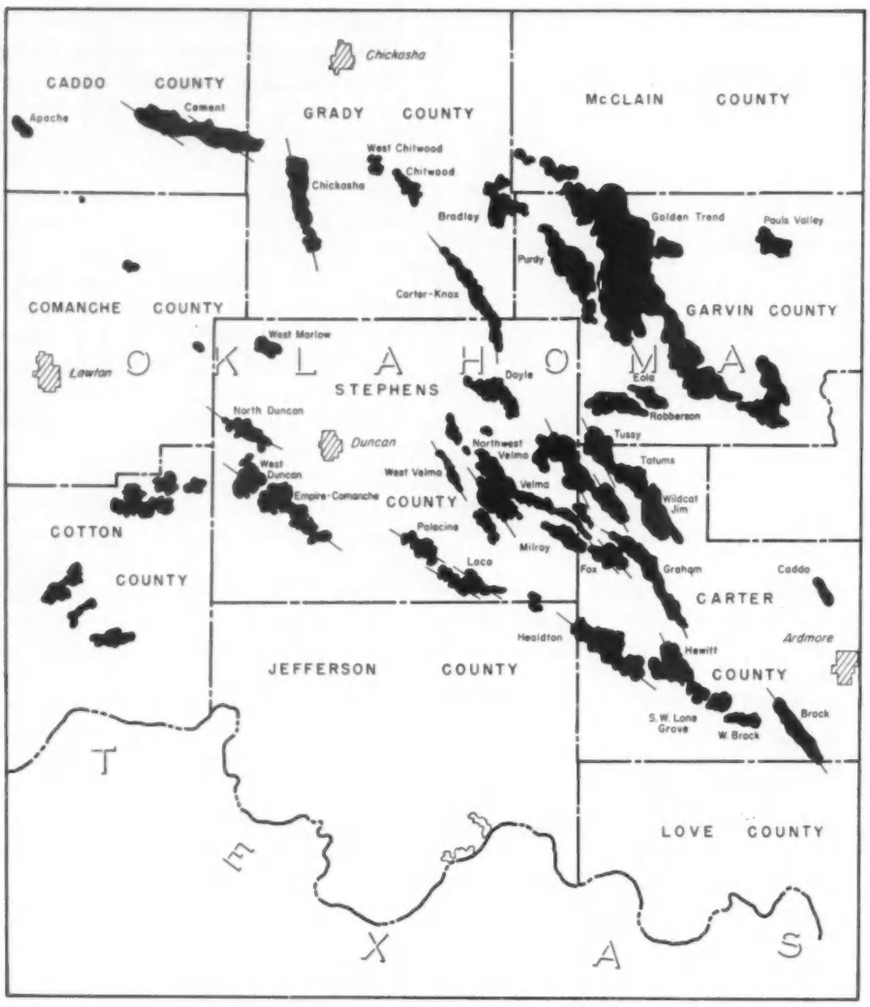


FIGURE 1—Regional map of southern Oklahoma.

# Southern Oklahoma— A Complex Geological Puzzle

**• Evidence indicates that no stratigraphic traps exist without a pronounced structural component.**

**• Fields whose traps are purely structural are abundant.**

**• Age of trap formation seems to have a profound effect on reservoir productivity.**

**By FRED P. SCHWEERS,** Mercury Drilling Company, Tulsa

In western Carter and eastern Stephens counties, Oklahoma, lies a broad mobile belt within which are located some of the most prolific oil fields in Oklahoma. Regionally speaking, this area is the shelving syncline, or hinge, which connects the Ardmore Basin with the Anadarko Basin. Paralleling the Wichita-Criner hills anticlinorium on the south, this shallow basin is flanked on the north by the Arbuckle mountains. Compressional movement effected by these two major anticlinoria have created an abundance of structural and stratigraphic complexities which afford an example of nearly every type of trap for petroleum accumulation known to exist.

Stimulated by the discovery of the Healdton field in 1912 and the demand for oil during and after World War I, intensive exploration for oil ensued in western Carter County, which overlapped into eastern Stephens County. In fairly rapid sequence, these multi-reservoir oil fields were opened up: Fox (1915), Wildcat Jim (1916), Velma (1917), Milroy (1917), Hewitt (1919), Doyle (1922), and Sholem-Alechem (1923). The original discoveries of these fields are not so remarkable as the fact that they foreshadowed a series of repeated new zone discoveries, usually of increasing importance. For example, no less than twelve important producing horizons were tapped in the Velma field during a 30-year period after its discovery.[1]

**Structure and Stratigraphy.** The key to this phenomenon is both stratigraphic and structural with the latter being the more dominant. Stratigraphically, porosity barriers within continuous sands have formed traps in unexpected places. The abundance of truncated, lenticular and onlapping sands also contribute. Structurally, intermittent orogenic uplifts and downwarps have caused decided shiftings of the anticlinal crests at repeated times.

Two major structural orogenies have caused a decided variation in the structural alignment of different fields. The earlier, the Wichita orogeny, occurred in Middle Dornick hills time and had an alignment of approximately N 65° W. Although affecting other structural trends, it had its most profound effect on a narrow belt extending from the present Wichita mountains to the Criner hills. The oil fields most conspicuously affected by the creation of this anticlinorium are Healdton, Loco, Milroy, Fox, Doyle and Cement. These fields have a structural alignment approximating N 65° W. All of them, except the Cement field, have had intensive erosion of the Morrow and pre-Morrow strata.

A later major orogeny was predominant in post-Hoxbar time. The Arbuckle Orogeny, as it is called, had a general alignment of N 35° W., and profoundly affected such fields as

Wildcat Jim, Tussy, Cruce, Knox and Chickasha. In these structures the effects of the Wichita orogeny, with its concommitant period of erosion, are barely perceptible.

The Wichita and Arbuckle orogenies have had about equal effects on other fields and structures. Brock, Hewitt, Graham, Velma, and Sholem-Alechem provide examples of this latter type. These structures have endured the erosional effects of the earlier orogeny, but their respective axes seem to correspond more closely to the more northerly axes of the later orogeny. In some instances, the results appear to have created an en echelon pattern.

Additional structural complexity is created by the intensification of structural closure at depth in some structures, and the flattening out at depth on others. The repetition of structural uplifts and pulsations readily explains the former. The latter circumstance, more often inferred than proved, is present usually in the geologically younger structure. In these latter, the incompetent shales of the Pennsylvanian strata have been intensely folded by compressional movements which have spent their force, so to speak, in the shallower strata but in the deeper pre-Pennsylvanian, competent beds have been folded to a lesser degree.

**Stratigraphic traps.** It is believed that no stratigraphic traps exist in southern Oklahoma without a more or less pronounced structural component. The immensity and intensity of structural closures may account for this evident circumstance. It is quite conceivable that some stratigraphic traps, of the type so frequently found in northern Oklahoma, may have existed in pre-Morrow time. If so, these traps have been so modified by later structural deformation as to be unrecognizable.

Perhaps one of the best examples of a stratigraphic reservoir is the erratic Goodwin sand of Springer age. This horizon produces abundantly, although irregularly between the Sholem-Alechem and Tussy fields in Sections 5, 6, 7 and 8, T1S, R3W and on the south side of the Sholem-Alechem field in Sections 4, 5, 9 and 10, T2S, R3W. More than 100 feet of porous sandstone is known to thin to nothing from one ten-acre location to another.

The onlap type of stratigraphic trap is exemplified by the Second Carpenter and Morris sand zones. Both of these are good pays on the north flanks of the Fox-Graham structures in Sections 15, 16, 21 and 22, T2S, R3W.

A classic example of the truncation type of stratigraphic trap is afforded by the Velma and southeast Velma Springer sands. A continuous belt of these sandstones is truncated beneath the Deese formation on the east flank of the core of the Velma structure and the north flank of the Milroy structure. With an oil column in excess of 3000 feet, this belt is slightly less than one mile wide and more than 13 miles long. It extends from Section 3, T1S, R5W to Section 20, T2S, R3W. Its N 65° W axis changes abruptly in the SE-¼ of Section 30, T1S, R4W to N 35° W as it respectively parallels the Velma and the Milroy axes.

**Structural traps.** Oil fields whose traps are purely structural are abundant in the area under discussion. However, the stratigraphic component is present on many structures of pronounced closure, and the stratigraphic trap type of production has greatly augmented production which is mainly due to structural traps. A similar close relationship between anticlinal closure and fault trap closure exists. In most cases, faulting is only incidental and has had insignificant, if any, effect on production. In a very few cases it is believed to be the main cause for the trapping of oil.

A prime example of a fault trap is the small, but potentially important, Northwest Velma structure, A small field, comprising two Springer oil wells, two Deese oil wells, and one Springer gas well (as of June 1956), underlies the Cruce-Velma thrust fault. This thrust fault has a displacement of more than 2500 feet and the barren upthrown side has overridden the productive downthrown side. The Skelly and Mercury Drilling Company Brittain 4 NW SW NE of Section 5, T1S, R5W, found more than 450 feet of saturated Springer sand at a depth of about 6000 feet. Formation dip in excess of 60° probably accounts for 50 percent of this thickness.

Although a number of small graben structures are known, none of these appear to account for the local accumulation. However, a portion of the Velma structure in Sections 23, 25, 26, 35 and 36 of T1S, R5W is an excellent example of a horst, and the two more or less parallel faults evidently account for the Simpson production between them.

The Sholem-Alechem field straddles the Carter-Stephens county line. Its two en echelon domes center in Section 13, T1S, R4W and Section 3, T2S, R3W. On each of these domes are folded smaller en echelon folds. "In this field, the principal component of the trap is anticlinal closure. Minor faulting appears to be present, but it does not have any apparent effect on the formation of the trap."[2] Hundreds of feet of structural closure are found in both the Deese and Springer formations.

**Importance of age of trap formation.** The age of trap formation apparently has a profound effect on the productivity of the associated reservoir. Older structures whose geologic history has involved the recurrance of later structural movement are the most prolifically productive. For example, Healdton, Hewitt, Sholem-Alechem and Velma have all shared in numerous structural upheavals from at least as early as Upper Dornick hills time to Permian time. It is conservative to estimate that these four fields will have a total ultimate recovery in excess of 800 million barrels of oil. About two-thirds of this amount has been recovered to date.

As further evidence of the importance of the age of trap formation, there is no ready explanation for

**Since the preparation of this article, Author Schweers advises that The Texas Company and Mercury Drilling Company's Prichard 1 has discovered Ordovician production on the Milroy structure. The well was completed at a natural flowing gage of 287 bopd thru a 10/64th-inch choke at a depth of 8982 to 9036 feet. The Northwest Velma structure now has five Springer oil wells. Predicated on the prolific British-American discovery, 29-3N-5W, Grady County, large block purchases have been made on the west flanks of the West Velma, Santa Fe and Cruce structures by The Texas Company, Mercury Drilling Company, The Ohio Oil Company, Continental Oil Company and Gulf Oil Corporation.**

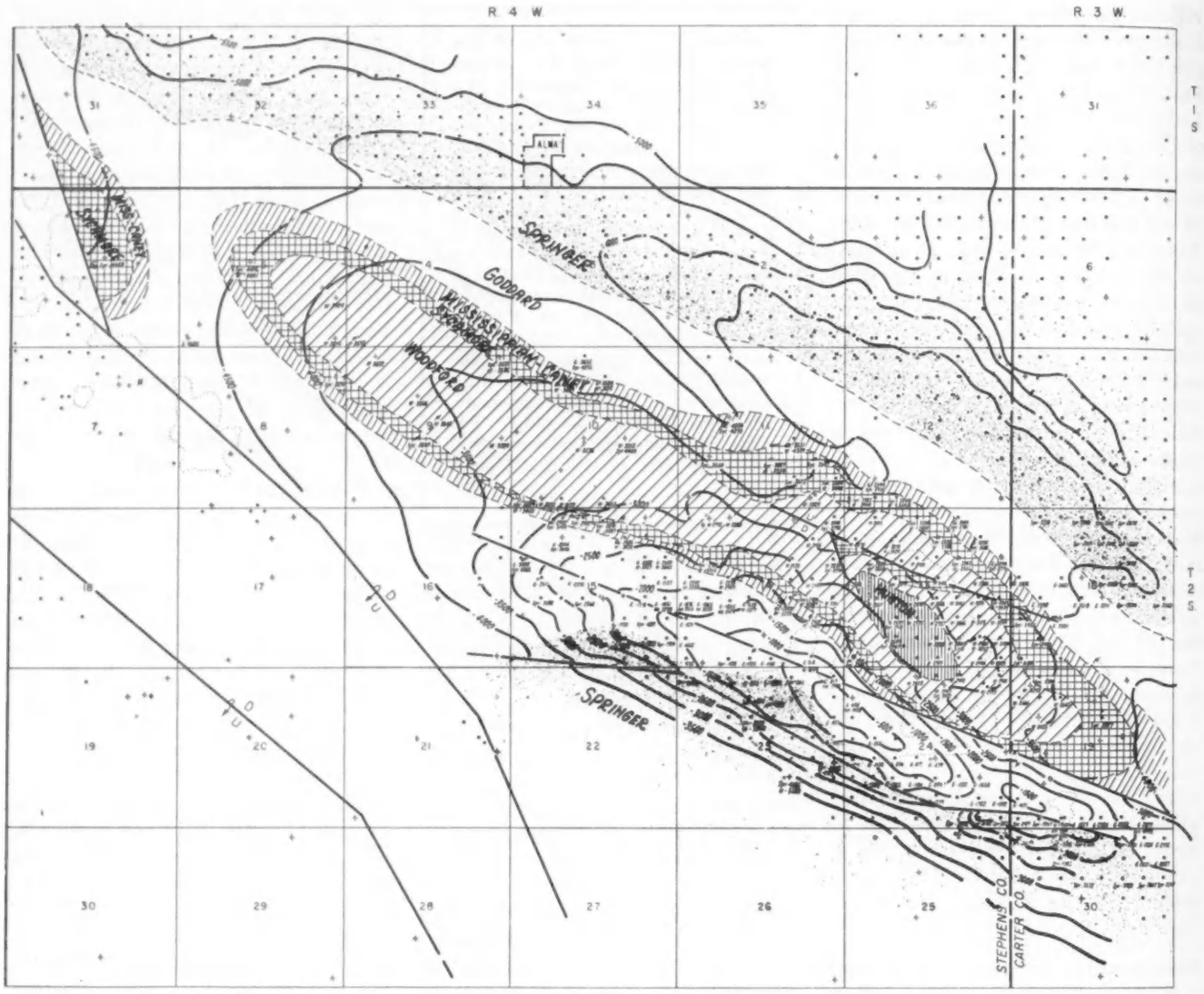


FIGURE 2—Milroy field, Stephens and Carter counties, Oklahoma. Contoured on Middle Dornick Hills unconformity.

certain horizons, whose structural attitude is decidedly closed, being barren on the same structure which is productive in younger horizons. The Tussy field of T1S, and T1N, R3W has more than 500 feet of structural closure, and is productive from several Deese sands. However, the thick blanket Sims sand of the Springer formation is water-bearing. In the Springer, only the lenticular Goodwin sand is productive, as previously mentioned. Since during pre-Deese time the Tussy field was low and probably represented a gentle east flank of Sholem-Alechem, its hydrocarbons of Springer age had no trap in the Sims and Upper Springer sands, but could be trapped only by the lenticularity of the Goodwin sand.

**Periodic exploration on old structures.** An example of a structure having all the required structural components necessary for a major oil field is the Milroy structure. This elongate domal anticline is about two miles wide and more than four miles long. Extending from Section 5, T2S, R4W to Section 30, T2S, R3W, it has in excess of 2500 feet of closure. Recurrent folding has taken place from Middle Dornick hills to post-Permian time. Yet the cumulative production to 1955 was only slightly more than 9 million barrels of oil, the greater part of which has been produced in the last six years as a result of fracture treatment.

The lack of first rate reservoir beds is believed to account for the relatively insignificant productivity of the Milroy field. Except for limited localities, the sands of Deese age are locally tight. The Springer sandstones have been truncated from most of the structure. Recent exploitation of the Sycamore and Hunton horizons may increase the field reserve somewhat.

The Ordovician has been tested in three wells on the east end of the structure. All three found the Bromide and Tulip Creek formations barren of porosity. The Oil Creek Oolitic limestone has produced several hundred thousand barrels in the Carter Harley 1 C-49, NE NE, Section 24, T2S, R4W. This same well has produced more than one million barrels of oil from the Oil Creek and Hunton combined since 1937. The east 40-acre offset was dry in the Oil Creek, and the only other well to be drilled to the Ordovician did not reach the Oil Creek. The west two-thirds of the structure has not been tested below the Hunton. There is a possibility of a porosity development in the Bromide on the western one-half of the structure since this portion lies close to the

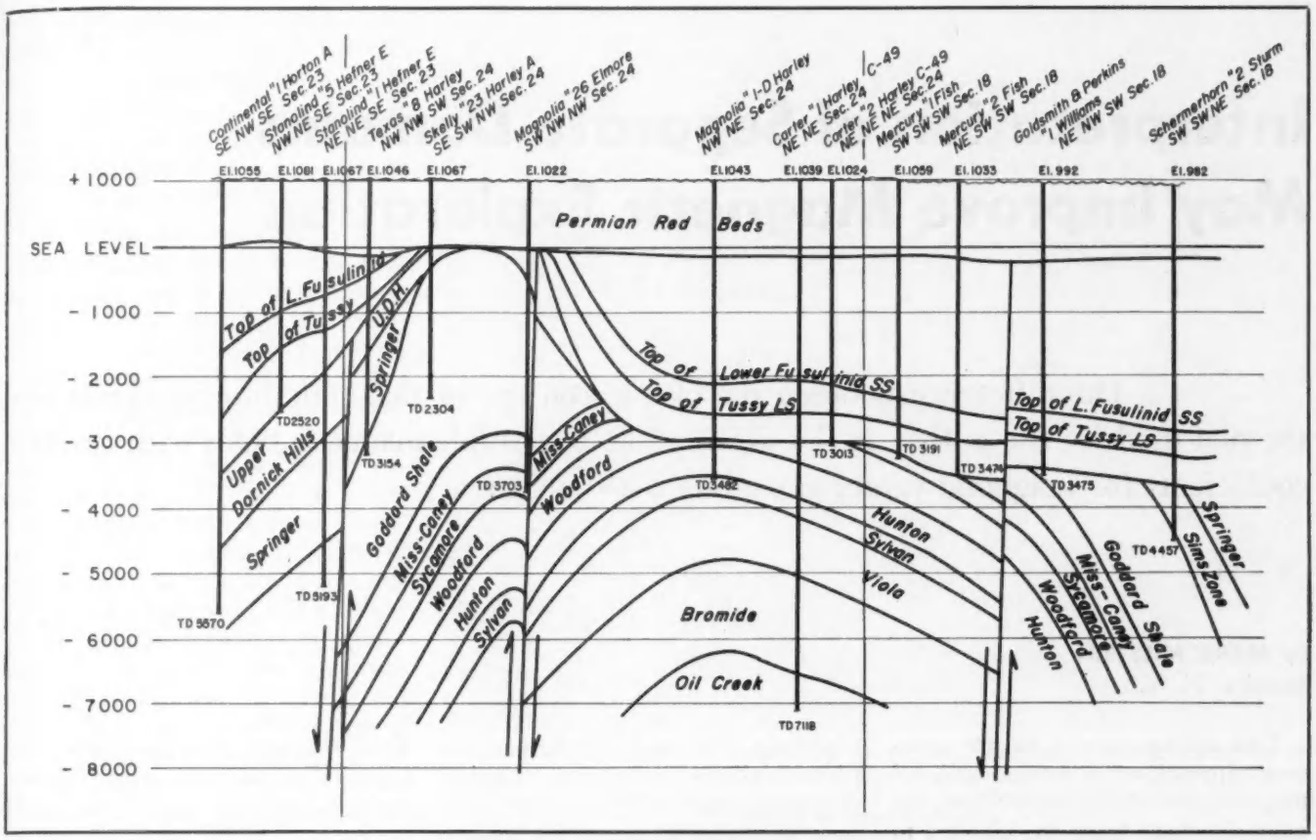


**FIGURE 3—Milroy field cross-section.**

previously mentioned Velma horst, where over 100 feet of Bromide sand is productive. The Texas Company and Mercury Drilling Company are currently drilling an 8750-foot geological wildcat in SE SE SW, Section 4, T2S, R4W.

The Milroy anticline provides some complicated and interesting phenomena. It is evident that a major fault paralleled the south flank during Morrow and post-Morrow time. Probably this fault or fault zone was normal-faulted and down-thrown to the south. It is believed that subsequent to its inception, the erratic detrital Upper Dornick hills sediments were laid down in a period of short-lived but rapid deposition. Simultaneously, erosion took place on the crest or upthrown side of the fault.

During or immediately after Upper Dornick hills time, it appears that the thick sediments on the southern down-thrown side underwent compressional movements from the south and southwest. The core of the competent pre-Pennsylvanian beds on the up-thrown side provided a buttress against which the formerly down-thrown incompetent beds were thrust, thereby reversing the fault or fault zone relationship. It is reasonable to assume that the zone of weakness created by the original faulting would offer the channel of least resistance for the later faulting. By this means, the ancient down-thrown block became the recent up-thrown segment. Later diastrophism probably intensified the thrusting movement. An excellent analogy is the Criner hills-Overbrook anticlinal relationship. Other faulting on the structure is minor except for occasional creation of separate reservoir conditions.

Another partially exploited structure is the Carter-Knox anticline. This structure is productive from the Permian and the Springer at relatively shallow depths. It has gained considerable attention recently because of the British-American Harrison 2, NE NE, Section 29, T3N, R5W. This test was drilled one mile west of the crest of the Knox structure on the theory that the asymmetrical fold would have a one mile westward and southwestward shift at the depth of the Simpson. This hypothesis was evidently correct, for the well reached the top of the Third Bromide sand at 15,113 feet. Over 100 feet of this sand was tested for a calculated flow of 175,000,000 cubic feet of gas per day, and 26,075 barrels of distillate. The well is currently the deepest producing well in Oklahoma. A few other Southern Oklahoma structures of the asymmetrical type have evidence of a similar axial shift, for example, Chickasha and West Velma.

Much more could be written about the geologic complexities of Southern Oklahoma than is possible in this allotted space. Perhaps the above outline, however, will acquaint readers who are more familiar with other areas with some of the problems and phenomena of this region. The very complexity of Southern Oklahoma geology makes it the most promising portion of Oklahoma for exploration for new oil reserves. Its periodic rejuvenations in the past foretoken future discoveries of new structures and new productive horizons on old structures.


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**ACKNOWLEDGMENT**

The writer wishes to make acknowledgment to the American Association of Petroleum Geologists for reprints of illustrations 2 and 3, which are part of "Milroy Field of Stephens and Carter Counties, Oklahoma," Fred P. Schweers, Petroleum Geology of Southern Oklahoma, Vol. 2.

# Interpretation of Separate Domains May Improve Magnetic Exploration

**The difference between the classic concept of magnetic interpretation and the one used by the author is the assumption of multiple magnetic fields with variable coefficients for magnetic values extending over any area.**

**By MARK MILSTEIN**
Jamaica, N. Y.

THE SHORTCOMINGS OF the common approach in the interpretation of magnetic observations are obvious, the main drawback being the inability to interpret available data adequately. The beguiling simplicity of the classic magnetic theory and the apparent ease of the operating techniques have been too attractive. Because of manipulation of the isogam picture, reconnaisance magnetic interpretation of structural conditions has been rendered largely ineffective, with the inevitable result that the magnetic method has been largely discredited as a tool for use in selection of wildcat drilling locations. Often misdirected efforts obscured the high revolving power of magnetics and reduced their applicability to the oil and other mineral exploration fields.

The writer wishes to illustrate what is meant by misleading and erroneous presentation of data through use of the figures that accompany the text. Assuming that Figure 1 represents a case of three finite strata with different magnetic susceptibilities, the separate effects of each are, in effect, calculated and the cumulative effects of all three members enter into the figure derived. The calculated, or recorded experimental curve represents the total magnetic effect of all three horizons. In common practice, the alleged errors of observation, etc., are "smoothed out." In fact, this practice causes individual characteristics of each member of the column to be wiped out. The small, measurable differences of the curve are of great diagnostic value; they point to variations in magnetic intensities, related to the changes in stratigraphy and in the attitude of various beds. In addition, the summary curve produces such a distorted distribution of maxima and minima that these values are unable to represent anything of a specific nature. Almost without exception, exploration based on such work will fail, any success being virtually fortuitous in nature.

Figure 2 illustrates a set of readings for three separate stratigraphic units characterized by magnetic contrasts and expressed, for argument's sake, in numbers. A traverse covering all domains is made and shows that the columns produce slightly variable magnetic effects, ranging from 120 to 140 units. The usual practice of contouring such incongrous values will lead to an isogam picture shown above, whereas, in actuality, all the three domains are distinct from one another and not associated in any way. The domains are characterized by distinct magnetic perameters and belong to different provinces each with different stratigraphic and structural meanings.

The basic difference between the classic concept and the one used by the author is the assumption of multiple magnetic fields, with variable coefficients for magnetic values, extending over any area, however large. Thus, for correct interpretation, it is essential to evaluate every domain (column) separately, as done by the author and as far as is known to him, by no one else to date. This may not be the easiest nor the simplest way, but undoubtedly the best for securing the most plausible results, which will be illustrated later. This interpretive approach led to several discoveries and is well illustrated in the regional survey of Sutton County, Texas (WORLD OIL, January 1953, Page 88), in the survey of the Hainsville salt dome (WORLD OIL, November 1956, Page 113), and is further enhanced by discoveries in reef limestone areas.

Reef limestones must be placed in a special category from an exploration standpoint. The current literature is full of laments and special pleadings, describing the difficulties allegedly inherent in the discovery of such traps. The writer hopes by demonstrating actual discoveries to show that the suggested technique of magnetic interpretation, besides having considerable economic advantages, simplifies exploration for such objectives and can lead to the pin-pointing of reefs.

The search for reefs is considerably facilitated by the very restrictive pattern of reef buildup which is virtually identical the world over. Corals, being of organic origin and of high purity, the former habitat of formerly living organisms, are placed on the highest, or close to the highest, posi-

tions in the paleo-topographical landscape. This selectivity is not influenced by the lithology of the underlying rock or by the basement. The foundation on which the corals develop may be of igneous, metamorphic or sedimentary origin.

The ecological conditions imposed on the growing corals demand their development within the highest elevation on the flexible part of the earth's crust in warm sea water, practically always on the basinward side of a shelf area. As stable areas are adverse to the development of corals, the advantage lies with the perpetually unstable areas which are constantly subject to oscillatory movements. Corals must also have access to waters of certain salinity, temperature, translucency, etc.; waters of high turbidity repress the development of corals. Speed of currents is also important and depths of from 120 to 180 feet below sea level is another limiting factor. The temporary changes of level are of lesser importance than the frequent upheavals encompassing the rise or subsidence of shorelines. On the other hand, the growth of reef limestone must be considered as an abnormal development, a form foreign to the normal sedimentary surroundings, developing in a direction contrary to the regular trend of sedimentation. Reef columns develop upward and, sometimes, on burial, preserve very steep or even precipitous flanks without developing much "talus" material on the slopes, while at the same time experiencing many of the visible effects of differential compaction. All such features produce a fine, variable and significant complex differing radically from the usual sedimentary patterns. Even the composition of the fore-reef sediments (predominantly sands) differs from the back-reef facies (mainly shales). Adding to all this, the basic pattern of reef configuration (fringe, bar and atoll) can be readily picked up by magnetic data if properly gathered and interpreted, greatly facilitating further differentiation. Thus the new technique brings out prominently the position of the reef in the otherwise normal section of the sedimentary column. In a detailed and careful analysis of the magnetic data such an imprint of peculiar ecological conditions cannot be overlooked. As a matter of fact, the narrow limitations of required environmental conditions favorable to the growth of corals simplify the search for such trap conditions. The search can be undertaken, furthermore, with a minimum of preliminary study. The knowledge of regional stratigraphic and structural patterns may serve as a reliable guide in such ventures.

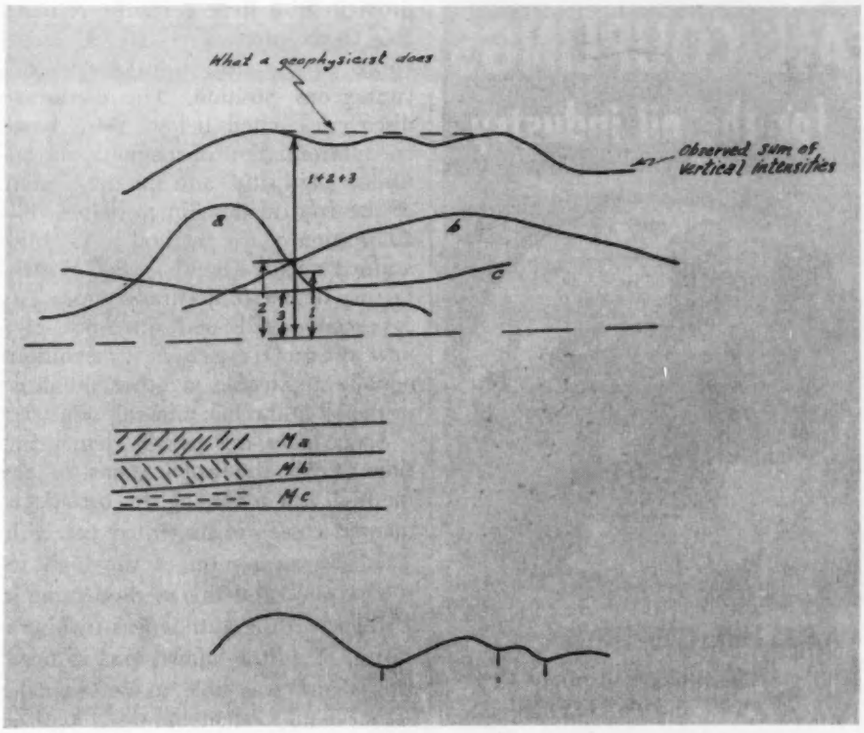


**FIGURE 1—The conventional interpretation of magnetic data causes the susceptibilities of specific stratigraphic units owing to their individual lithologic traits and sturctural attitudes to be lost through averaging out the sum total of the magnetic values, giving rise to interpretive data of no specific meaning.**

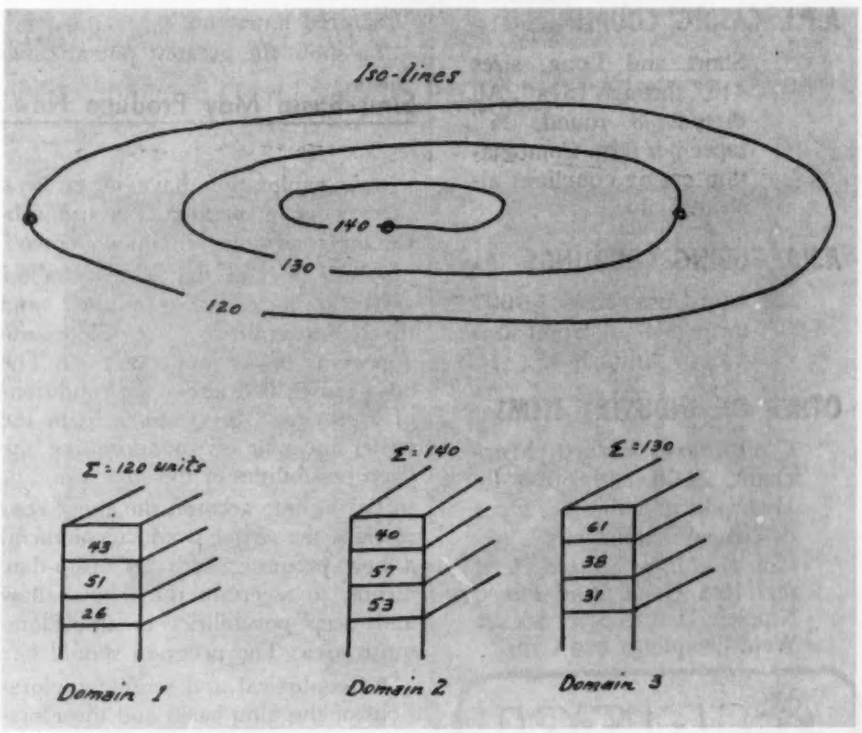


**FIGURE 2—Spotty, reconnaissance magnetic exploration is often misinterpreted through the envisioning of imaginary drilling prospects covering a large area. This idealized figure shows how three reference points, each representing entirely separate and distinct magnetic domains, are erroneously tied together in an attempt to validate a speculative wildcat drilling venture. Poor results from such attempts have tended to negate the value of magnetics as a tool for oil exploration.**

Leaving aside the economics of the case, a geophysicist approaching this

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problem with some certainty of being able to pin-point a reef spread in advance of the drill is in a very advantageous position. The confirmed discoveries, cited below, were based on differentiation of magnetic susceptibilities "in situ" and the application of the fruitful domain principle. The adaptation of the method to establish a third vector (depth) with a satisfactory degree of accuracy (from 2 to 5 percent) leads to formulation of a new magnetic-geologic technique equally applicable in other situations in the oil and other mineral industries.

Space does not permit demonstration of all the applications of the method, but a few of the best documented cases are presented herewith. The first suggestion of the high resolving power of this method came in 1942, when the author was making a survey of a little-known area in north Texas and was able to determine a peculiar and (then) unusual type of limestone manifestly located in a high structural position. For want of a better name, it was usually referred to as "fractured limestone."

To show the greatest potentialities of this magnetic approach, the author in a recent test survey was given a set of magnetic readings, secured from a traverse run across the general strike of a sample area unknown to him at the time. In the opinion of the party submitting the basic data, the results are impressive. "Although certain features interpreted (in your report) cannot be confirmed by geological data now available, much information, geophysical as well as geological, outlines some of the features suggested (by the new magnetic interpretation) . . . The profile is located in Texas and was run across a known field, which produces from a Strawn reef. The main feature suggested by your work outlines an uplift which is not only suggested by limited subsurface control but is well outined in addition by a detailed gravity survey. Its location as suggested by this survey agrees with the location outlined in your profile. The two dots over stations 78 and 87 well outline the producing field . . ."

This nearly perfect accord between the calculated and actual conditions is greatly enhanced by the accuracy of the calculated discontinuities (depths). —**The End**

## Sinu Basin May Produce New Reserves

*Continued from Page 155*

seismic exploration have never been carried out in the area. The true subsurface conditions remain unknown.

• It is obvious that a few shallow wells in a complex, faulted and thrusted structure such as Floresanto appears to be, are not conclusive. The deep test drilled under the conditions of Floresanto 10, would seem to the writer meaningless in appraising the deep possibilities of the structure.

Taking into account the above conclusions the writer would recommend a new program, with an up-to-date means, to ascertain the true shallow and deep possibilities of the Floresanto area. The program should be:

• Geophysical and seismic explorations of the Sinu basin and the Floresanto area.

• Shallow wells in the southern and western parts of the anticline aiming at the several Floresanto sandstone beds, which are capable of production.

• A deep well west of the surface axis of the anticline should be drilled to reach the Middle Oligocene or Eocene formations.

• Exploratory wells should be made along the eastern flank of the structure, in the Pajuil formation with the object of locating reservoir sands in the Miocene beds above the Floresanto formation.

**ACKNOWLEDGMENT**

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To handle deeper wells and high formation pressures, operators are demanding . . .

# High Yield Strength Oil Well Casing

By **S. PRISUTA,**
Metallurgical Investigator, and
**H. B. EMERICK,**
Director of Technical Services
Jones and Laughlin Steel Corporation
Pittsburgh, Penn.

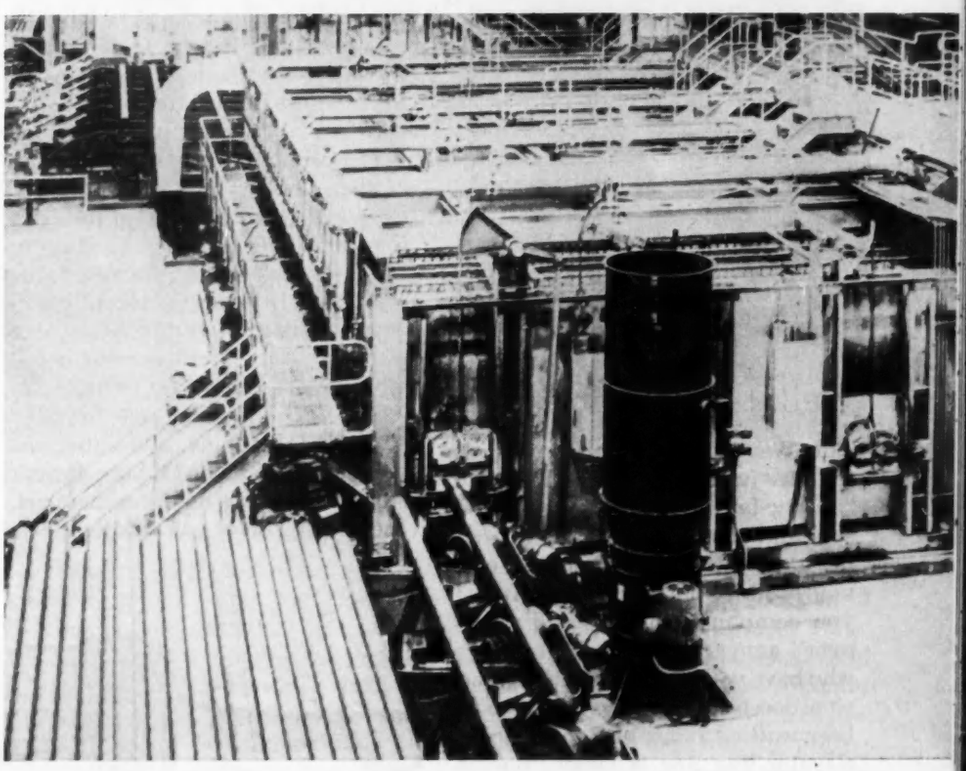

FIGURE 1—An over-all view of the Seamless Tube Mill specialties department. The operation starts at bottom of photograph.

THE QUENCH AND temper process of heat treatment now being utilized for the production of high yield strength oil well casing has proven more efficient than former heat treating practices, and has enabled manufacturers to supply the oil industry with casing of superior mechanical properties.

Recent work has demonstrated the feasibility of producing casing in the range of 140,000/150,000 pounds per square inch yield strength by this process. The petroleum industry visualizes the need for this extra-high strength casing for use in deep, high pressure wells.

Since 1954, high yield strength oil well casing has been produced from plain carbon steels by utilizing the quench and temper process of heat treating. High strength casing, classified by the American Petroleum Institute as grades N-80 and P-110. (80,000 psi and 110,000 psi yield strength), usually is made from normalized or normalized and tempered steels containing manganese, molybdenum, vanadium, or combinations of these alloys. Not too many years ago,

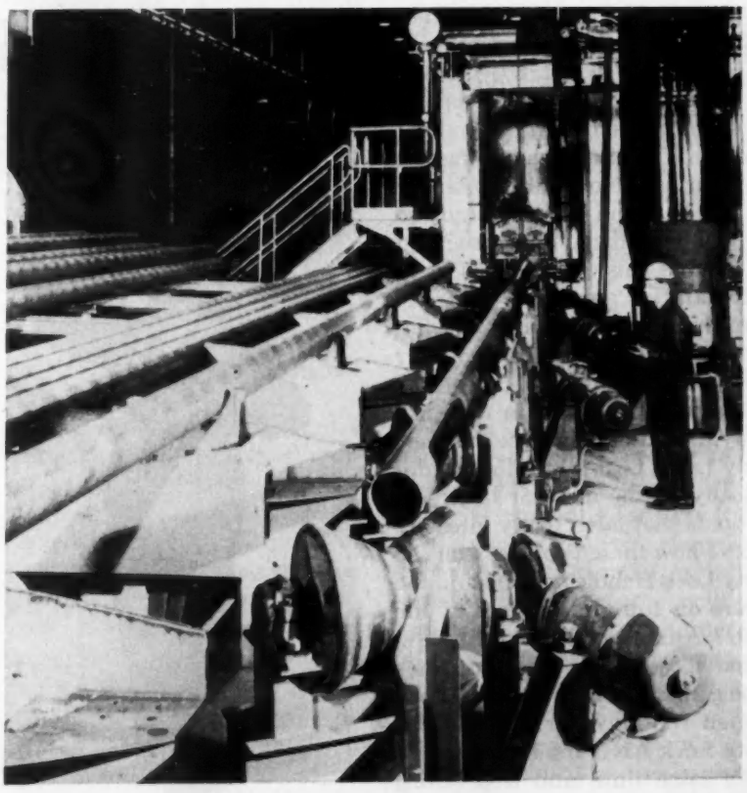

FIGURE 2—Charging end of high heat furnace. Pipe about to enter furnace. Note 30 degree skew on inlet rollers.

## Well, they did it again!

This Web Wilson outfit that I work for has just come up with a new "Safety Lock" Tubing Elevator—so safe and easy to use that I'm real proud of them! ★ So, bend an ear, you production service operators; you company "pulling and workover" gangs; and you contractors who have your own production (and who doesn't these days) . . . you've been *waiting* and *hoping* for a tubing elevator like this. ★ Okay, Mac, if you think I'm just poppin' off, I might mention casually that *one* production service company in West Texas *now has in service* fifty (50) Web Wilson SAFETY LOCK Tubing Elevators, and *has just ordered* EIGHTY (that's right, 80) more of 'em! And the boss of that company is as smart and successful a "puller" as you will meet anywhere—maybe even smarter. ★ Now, will you kindly step over here and listen carefully so I can sell *you* a half dozen or so? You can see that this elevator has man-sized handles away out in front where the links can't pinch any fingers—you can see it's the popular Web Wilson "Center Latch" design—and see that you bolt in the links to stay. But, did you notice that new Safety Latch Lock which locks automatically as the elevator is closed, and holds that latch really latched? Observe how those two hooks on the Safety Lock Handle snap behind the fingers on top and bottom of the latch? And they'll stay hooked around those fingers, too, until one of the gang pulls on the Safety Lock to open the elevator. THEN the Safety Lock AND the Latch release at the same time, and that strong spring you see wrapped around the hinge pin opens up the elevator as slick as a cat's tonsils. ★ It's easy to *see* why production gangs like 'em, so now let's talk about things you can't *see*, but which make a lot of sense to the man who pays the bills . . . These new Safety Lock Tubing Elevators are made of heat-treated Manganese-Molybdenum steel—there are mighty few parts and each part is simple and strong—the top of the elevator that fits under the coupling is flame-hardened for extra long wear—all of which adds up to make one h--l of a good elevator which will help keep accident insurance premiums way down low. Are we all agreed? The two most popular sizes are ready now: one for 2" (2⅜" O.D.) tubing; one for 2½" (2⅞" O.D.) tubing, and either one will handle 65 tons of tubing. If your supply store does not have them yet, they'll get 'em for you mighty quick.

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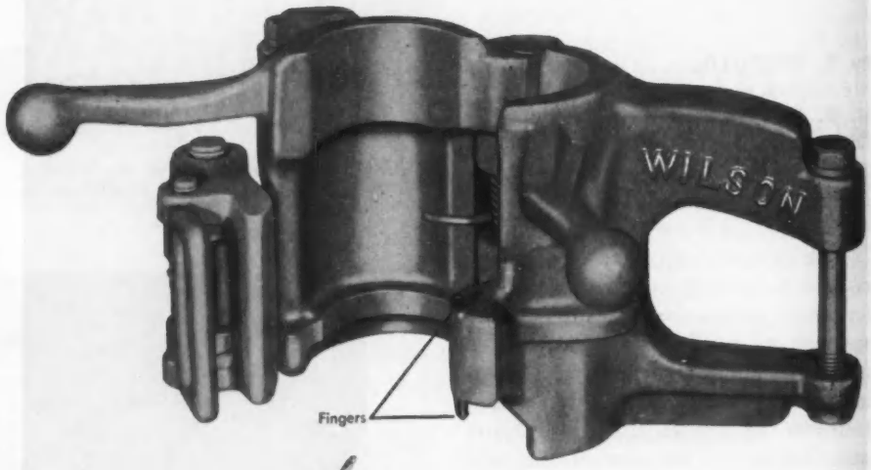

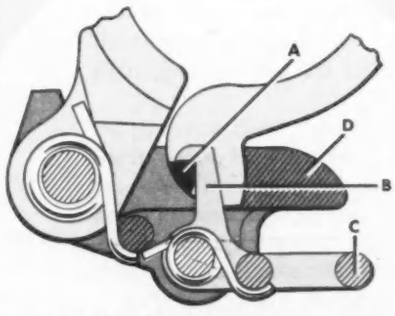


**SHOWING OPERATION OF SAFETY LOCK**
A- Finger — B- Safety Hook
C- Safety Latch Handle
D- Latch

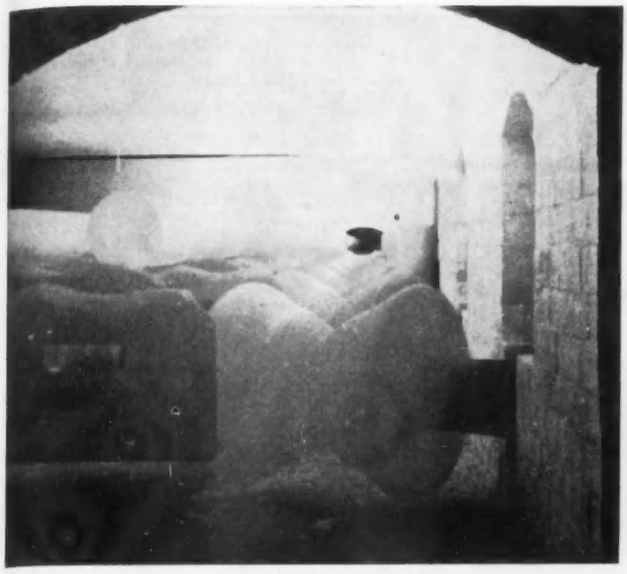

FIGURE 3—Interior of high-heat furnace just prior to discharging pipe to quench operation.

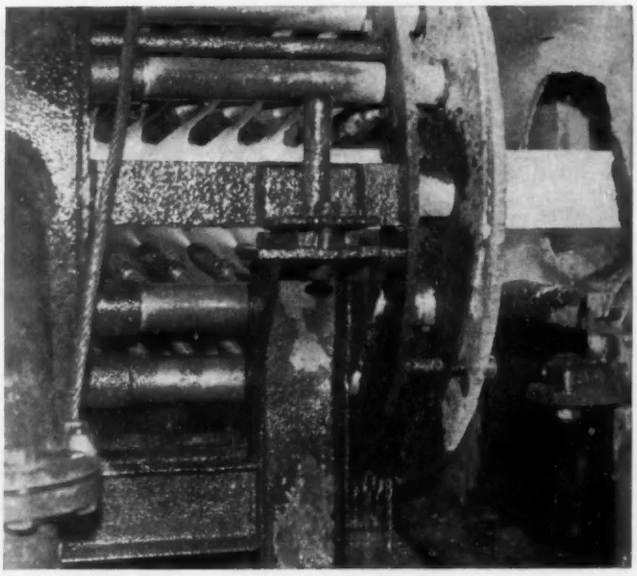

FIGURE 4—View of casing leaving furnace and entering quench ring. Direction of travel is right to left.

the strength levels required of oil well casing were met satisfactorily by the mechanical properties of grade C (45,000 psi yield strength), grade D (55,000 psi yield strength) and a limited amount of a modified grade D alloyed with molybdenum to obtain 80,000 psi yield strength. These have given way to the present grades: H-40 (40,000 psi yield strength), J-55 (55,000 psi yield strength) and N-80 (80,000 psi yield strength). When the petroleum industry was forced to probe deeper for new sources of oil, the need became mandatory for high strength casing that could withstand the various stresses accompanying higher compression, tension, burst and impact forces. This demand brought about the production of casing of higher strength levels through greater use of alloy additions.

Although casing made from steels containing alloy additions generally meets the mechanical properties required by the petroleum industry, the use of such alloys proves restrictive in a number of ways, a few of which are:

(a) limitations on productivity brought about by necessity to adhere to slow heating and cooling cycles
(b) lower ductility as the strength level increases
(c) alloy contamination of recycled scrap
(d) scarcity and government restrictions on alloys

In order to minimize the use of alloys and still meet the expanding requirements of the oil industry, pipe manufacturers foresaw the need for developing high strength characteristics in a different manner. One process stood in prominence—water quenching followed by a tempering treatment, which promised also the possibility of attaining high strength in combination with high ductility.

**Development of Heat Treating Facilities.** Investigation of the quench and temper process for tubular products was initiated as early as 1946. Experiments at that time indicated that a high strength material could be developed with the medium carbon steels that were then being processed to the lower yield strength levels. The need for casing of yield strength levels in excess of 55,000 psi was not great; but as the oil industry started drilling deeper, the need for higher strength casing became correspondingly greater. The first move by the manufacturers was toward modifications in the chemistry of the steel through alloy additions such as vanadium, chromium, nickel and molybdenum. Mechanical propetries on the level of 80,000 psi and later 105,000 psi yield strength were attained. However, due to restrictions in procuring these alloys, and processing difficulties brought on by the limiting characteristics of alloy heat treatment, a new method of production appeared to be the only means of meeting anticipated future oil country demands.

Plans were formulated for the installation of heat treating equipment with a burner capacity of 30 tons per hour that would insure production of a uniformly heated product. The product was to be quenched and tempered to the high yield strengths necessary in the deeper wells of the oil industry. The heat treating process was established on a continuous, automatic basis, capable of processing casing in sizes ranging from 4½ inches to 9⅝ inches O.D., in lengths up to 50 feet.

Figure 1 is an over-all view of the installation. Both furnaces can be fired with either coke gas or natural gas. The furnace in the foreground is the high-heat furnace in which the casing is heated to approximately 1600° F. prior to quenching. The furnace in the background is the tempering furnace which is utilized for restoring ductility in the as-quenched casing.

To charge the high-heat furnace, casing is placed on the charging table in the left foreground by traveloaders or cranes. The casing then drops onto the inlet rolls which are skewed at an angle of 30 degrees for rotation of the casing entering the furnace. Rotation of the casing both in charging and discharging is essential in effecting uniform heating of the cold casing surface as it enters the furnace, and in minimizing distortion of the casing as it passes through the quench unit. When the product has fully entered the furnace, a limit switch control paddle is tripped by the front end of the pipe to actuate the kick-off arms which transfer the product from the

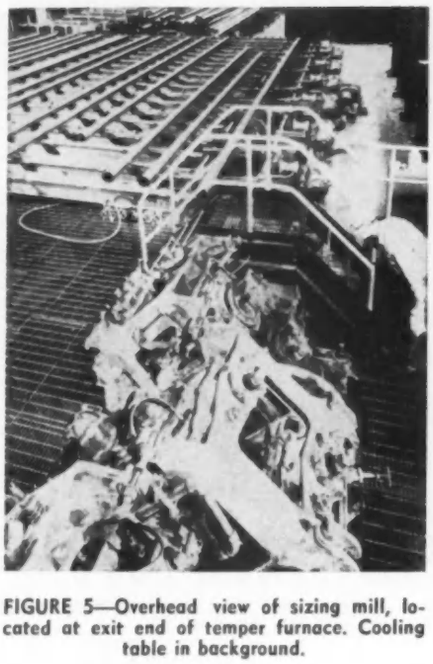

FIGURE 5—Overhead view of sizing mill, located at exit end of temper furnace. Cooling table in background.

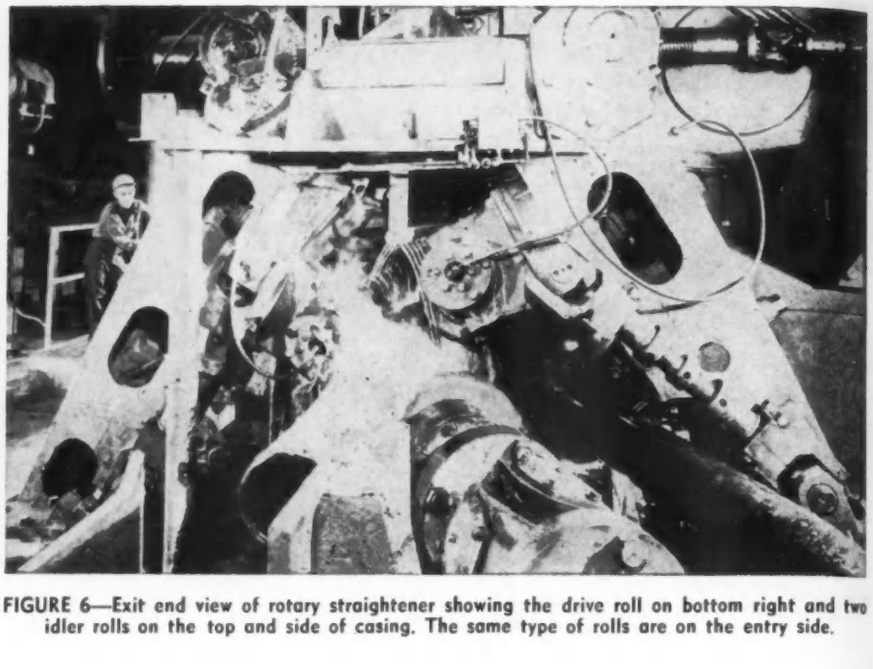

FIGURE 6—Exit end view of rotary straightener showing the drive roll on bottom right and two idler rolls on the top and side of casing. The same type of rolls are on the entry side.

rolls onto the furnace rack. Figure 2 is a view of the casing as it enters the furnace.

The furnace mechanism and racks are so designed that the product is rotated slowly as it progresses through the furnace, thereby assuring uniform heating of the entire casing wall. Heretofore, furnaces for heating pipe generally have been of the gravity or hand-roll-down type, or a drag chain conveyor type which moves the casing through the furnace. Both types are designed to rotate the pipe as it travels through the furnace. However, the casing, at room temperature, usually is fed directly into the hot zone of the furnace where temperatures in the neighborhood of 1600° F. are encountered. The inlet and exit rolls of these earlier furnaces are of the straight line type. The thermal stresses set up in the product due to the hot gases striking one side of the casing (the other side being relatively cold) can cause severe warpage in a matter of seconds. This distortion prevents rotation of the casing and it is dragged or pushed through a major portion of the furnace before it absorbs sufficient heat to straighten out and roll the balance of the way. Such conditions are not conducive to uniform heating which is essential to the quench system of production. The combination of skewed entry rolls and walking beam method of transport over the furnace hearth effectively controls the tendency toward distortion caused by uneven initial heating.

Figure 3 is a view of the casing approaching the exit rolls of the furnace. Here can be seen the fluted furnace racks that lift the casing and move it forward to the edge of the next groove, thus allowing the casing to rotate as it progresses through the furnace.

As the casing, now at 1600° F. leaves the furnace, it enters the quench ring where in a matter of seconds it is rapidly quenched to slightly above room temperature. Figure 4 is a view of the casing passing through the water sprays.

When the trailing end of the casing leaves the furnace, it is momentarily stopped just short of the water sprays. This is done to eliminate a double quench action which could result in quench cracks on the inner wall of the casing. The exit rolls are reactivated by the next pipe in the furnace as it drops from the furnace rack onto the exit rolls.

After passing through the quench, the casing is lifted from the conveyor rolls by means of mechanical fingers and transferred to a rack which carries it to the entry rolls of the tempering furnace. In the as-quenched condition, the casing is too hard and brittle for any practical use; therefore, it is subjected to a temper treatment to restore toughness and ductility. As the casing leaves the temper furnace, it enters a three-stand sizing mill which assures a product of specified O.D. dimensions. Figure 5 is an overhead view of the sizing mill and the cooling bed which transfers the casing to conveyor rolls leading to the rotary straightener.

**Straightening and Finishing.** Figure 6 is a view of the rotary straightener operation. Rotary straightening insures a product that is within commercial tolerances for longitudinal straightness. In those cases where collapse resistance is critical, the casing is subjected to a stress-relieving heat treatment following the rotary straightening operation.

After straightening, the casing is conveyed to an inspection table where it is subjected to a thorough visual inspection for internal and external defects as well as straightness.

After the surface inspection, the casing is conveyed to the cut-off machines where the ends are inspected visually and by a magnetic particle process for defects before threading. From here the casing is transferred to the threaders or grind tables or, in the case of P-110 casing, to special tables for full-length magnetic particle inspection for sub-visual defects.

**Principles of Heat Treatment.** Efforts to provide highly developed equipment for finishing seamless high strength casing along with insuring maximum efficiency in transferral of the product from one operation to another have been highly rewarding in meeting trade requirements with a quality product. However, the really unique component of this new production line is the method of heat treatment, the heart of which is the quench unit.

The principles involved in quenching steel to high strength properties are well established. The three basic steps which must be considered are heating, cooling and tempering.

In heat treating seamless casing by the quench and temper process, the first operation involves heating uniformly to above the upper transformation or critical temperature known as $A_3$, where the change from alpha to gamma iron takes place. Carbon and other elements are dissolved in the gamma iron forming the solid solution—austenite. The casing is now ready for the second phase of the operation—cooling, or, in this particular instance—quenching.

The purpose of quenching steel is to produce a structure which, before tempering, provides the highest hardness attainable in steels of low alloy content, i.e., martensite. The methods and media that can be used to bring about the change from austenite to martensite are affected by a number of complex variables which dictate the minimum cooling rate required. Water in the form of high pressure sprays effectively meets the requirements for the extremely fast cooling demanded by plain carbon steels.

In the actual process of quenching, the power of the liquid to cool the surface of the metal changes with the surface temperature of the work piece. This is accomplished in three distinct phases of heat dissipation, illustrated in Figure 7.

**Stage A—Vapor Blanket Cooling.** As the water contacts the surface of the hot metal, a thin vapor film forms and cooling takes place by conduction and radiation through the gaseous film. Heat dissipation is relatively slow and persistence of this stage is highly undesirable.

**Stage B—Vapor Transport Cooling.** Termination of stage A is marked by wetting of the metal surface. Cooling is accomplished by the vapor forming in bubbles and being carried away by gravity and convection currents. This is the fastest stage in the cooling process where the unique cooling powers of the water quench are realized.

**Stage C—Liquid Cooling.** The B stage ends when the surface temperature of the metal approaches the boiling point of the quenchant. Vapor no longer forms, cooling is by conduction and convection, and the rate of heat

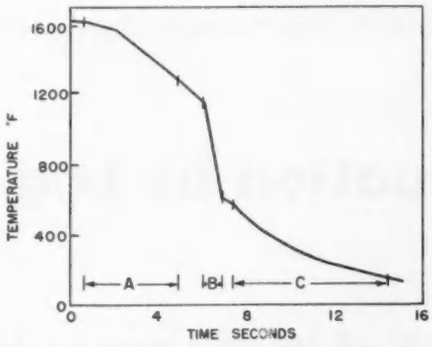


**FIGURE 7—Cooling curve depicting three stages of heat dissipation occurring during spray quenching.**

extraction is greatly decreased.

Persistence of the initial vapor stage, or of localized vapor masses in the second stage, will cause slow cooling of the affected areas thus permitting the formation of high temperature transformation products and soft spots. It is evident that the crux of cooling by the quench method is to reach stage B in the shortest possible time. This is accomplished most effectively by an agitated quench or, as in this particular setup, a spray quench system.

**Quench Unit.** Figure 4 is a closeup of the actual quench unit being utilized at one company. The unit consists of several horizontal headers, each with a series of nozzles spaced in such a manner as to insure complete coverage of the casing. The first few rows of nozzles are designed to act as scale removers while performing the job of quenching. Removal of the scale is important; if not removed, it would act as an insulator or blanket, thus reducing the severity of the quench. A lessening in the severity of the quench enhances the opportunity for the higher temperature products to form, thus resulting in impairment of mechanical properties or a degree of non-uniformity which is undesirable in the finished product. The balance of the nozzles insure quenchant temperature at the casing surface until the entire wall section has cooled. If the quenchant temperature is not maintained on the casing surface after the initial sprays, the heat contained in the casing wall can not be withdrawn as quickly as it should be, again enhancing the opportunity for undesirable transformation products to form.

The nipples to which the nozzles are attached are canted away from the approaching pipe to minimize the flow of water back along the casing wall, thus lessening the possibility of pre-quenching the casing before it has entered the quench ring. Pre-quenching is detrimental because it initiates the quench action prematurely, nonuniformly, and at a very low severity; pre-quenching lengthens the stage A phase of the cooling curve and valuable time is consumed in a relatively inefficient phase of cooling. Ideally, the transformation from austenite to martensite must be accomplished in a matter of seconds.

**Grades of Steel.** To accelerate transformation from austenite to martensite and to compensate for possible variables conducive to incomplete quenching, grades of steel were selected that were known to possess adequate hardenability. Because of the numerous casing sizes produced, and in order to maintain a high level of production with the least number of complexities, several standard grades have been established from which 22 combinations of pipe diameters and wall thicknesses can be produced. The chemical composition of each grade is controlled to insure proper transformation in the heaviest wall casing processed from that particular grade.

Following are comparative chemical analyses of the grades now being utilized for the quench and temper process, and the grades that contain alloys to produce casing of the same strength level by conventional normalize and temper heat treatment.

| Grade | C | Mn | Si | Mo | V |
|---|---|---|---|---|---|
| Alloy—N-80 | .43 | 1.60 | .20 | .20 | — |
| Alloy—P-105 | .25 | 2.50 | .20 | .20 | .20 |
| Q&T—N-80 | .31 | 1.30 | .20 | — | — |
| Q&T—P-110 | .31 | 1.45 | .20 | — | — |

The first alloy grade shown, N-80, derives its strength from carbon, manganese and added molybdenum. The second, P-105, derives its added strength from a much higher manganese content and about .20 percent vanadium. The next two grades are the quench and temper grades which are processed to the same strength levels as the alloy grades, but with considerably better ductility in the finished product.

# Formation Evaluation by Log Interpretation

## Part 2. Interpretation of Well Logs in Water-Wet Rocks of Intergranular Porosity

**A positive breakdown of total water saturation into bound and movable water is provided for well productivity forecast.**

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SHALY SANDS THAT behave according to the characteristics attributed to them are always water-wet for if they were oil-wet, they would not give rise to the main electrical characteristic of a shaly sand, namely, that it exhibits a reduced SP deflection which cannot be explained by any other modifying factor than clay hydration and double-layer potential.

In addition, shaly sands may be recognized by their low resistivity. This in itself is not a sufficient condition because low formation resistivity is at times caused by the presence of conductive minerals such as glauconite (example: the McLish, Bromide, Oil Creek, Tulip Creek sands, Oklahoma) or by extremely high porosity and low formation factor (example: Tuscaloosa sand, Louisiana and Mississippi; Chat, Kansas and Oklahoma). Shaly sands, generally show low invasion by fresh muds because of clay swelling and, if thick enough, they may exhibit a resistivity gradient in the transition zone of water to oil saturation.

Ever since the recognition that oil and gas productivity may be determined from certain simple characteristics of electric logs, it has been observed also that clastic shaly formations did not follow the rules established for clean sands because oil and gas production was at times obtained without benefit of any appreciable SP resistivity deflection. Within the past few years, a serious attempt has been made to explain the fundamental difference in the behavior of electric logs in clean and shaly sands. This led to the recognition of various sand types.

There are various classes of shaly sands and one may first distinguish between shaly sands and sandy shales. A sandy shale is one where the pore spaces between sand grains are completely filled with clay or shale particles. On the electric log, it has no negative SP value and may not be distinguished from shale.

A shaly sand is one in which the pore spaces between the sand grains are partially filled with clay. It still gives rise to negative SP deflections with fresh muds, and the magnitudes of the SP values compared to those that would be obtained in clean sand are a measure of the amount of pore space filling by clays. An SP reduction is, therefore, one of the main characteristics of a shaly sand. A further reduction in the SP value may be due to the presence of oil and gas and because of the attendant increase in true resistivity. The presence of oil by itself, however, further decreases the SP deflection.

One may distinguish the following types of shaly sands:

(a) Laminated (sandwich) type made of alternations of shale and clean sand partings. A typical example is the Mesaverde (Wyoming). On the logs it is characterized by an SP reduction in accordance with the percentage of shale in the gross section. Close examination of the SP and of short investigation resistivity devices shows small ripples in the curves at each of the partings.

(b) Dispersed or interstitial clayey sands (colloidal shaly sands). Examples are most of the Cherokee sands of the Mid-Continent: Red Fork, Bartlesville, Prue, Cleveland, Deese, etc., and most of the Gulf Coast Frio and Wilcox sands, also, the Olmos sand of upper Cretaceous Age. These sands are characterized by SP reduction, but without ripples on the SP or on the short normal curves. They lead very readily to clay blocking of the formation by fresh mud filtrate because of hydration of the reactive clay which they often contain, especially when it is montmorillonite.

(c) Combined colloidal-laminated shaly sands where

interbedding of dirty sands is present in shale laminations. The electric log characteristics are the same as above. Examples may be found in the Mesaverde formation in Wyoming, the Fruitland section in San Juan Basin, New Mexico etc. Many of the previously mentioned sands may grade laterally into laminated shaly sands.

(d) Nonreactive ashy sands. These are characterized by no SP reduction and very low resistivity even when oil productive. Typical examples are the Tuscaloosa and Eutaw sands (Louisiana, Mississippi and Alabama). It is believed that these sands have an unusually high specific surface because of the fine, ashy, but nonreactive minerals which they hold. They retain a large amount of bound water by adsorption, and clean oil may yet be produced from such reservoirs when formation water saturation is as high as 65 or 70 percent of pore space. Interpretation of such sands requires a knowledge of local conditions, but quantitative evaluation of productivity may be made through evaluation of bound-water filled porosity as will be shown in this section.

(e) Sand containing electronically conductive minerals such as sulfides, oxides and more specifically glauconite. Green sands containing glauconite exhibit very low resistivity even when producing clean oil because of the conductive circuit provided by the conductive minerals dispersed within the porous network. This occurs whether or not oil is present. Such formations do not give rise to an SP reduction and they are characterized by very low formation and cementation factors. Typical examples are the McLish, Oil Creek, Tulip Creek sands of Simpson Age (Oklahoma). Interpretation of these sands is by the usual procedure but high sensitivity logging scales are advisable in order to render the resistivity values readable with the required accuracy.

Only the shaly sands giving rise to an SP reduction effect lead to special interpretation problens for the others may be solved by standard techniques described for clean water-wet rocks, somewhat more carefully applied.

**Review of published methods of shaly sand interpretation.** Six techniques have been suggested in the literature within recent years for the interpretation of electric logs in shaly sands. They are evaluated here on the basis of a comparison with a modified form of Archie's law which has proved altogether reliable for clean porous rocks (of intergranular type porosity and water-wet). It will be shown that few techniques allow fully for sand shalyness on a reasonable basis. However, a new and comprehensive technique suggested herewith may prove more suitable as it permits a breakdown of the water saturation into bound and movable water and thereby it provides a more dependable way of ascertaining the oil productivity of a well.

**Modified Archie's Law.** Archie's formula for clean rocks, water-wet and of intergranular type porosity may be written as follows:

$$S_{we}^2 = \frac{R_o}{R_t} = \frac{FR_{we}}{R_t} \qquad (18)$$

In the flushed zone around a well bore, this formula becomes:

$$S_{xo}^2 = \frac{FR_{mf}}{R_{xo}} \qquad (19)$$

Since the rocks considered are clean and devoid of reactive clays and shales (or other minerals reactive with the mud filtrate), the formation factor F is an invariant with water salinity and substituting the value of F obtained from (18) into (19):

$$S_{we}^2 = S_{xo}^2 \cdot \frac{R_{xo}}{R_t} \cdot \frac{R_{we}}{R_{mf}} \qquad (20)$$

For clean rocks the following relation is valid for the SP curve after corrections for thin bed, bore hole, invasion, true resistivity and streaming potential,

$$SSP = -K \log \frac{R_{mf}}{R_{we}} \qquad (21)$$

where K is a factor which varies only with temperature; the value of which may be obtained from: $K = 70.7 \frac{T_f}{538} = .131\ T_f$, where $T_f$ is absolute formation temperature in °R.

Substituting (20) into (21) and transforming:

$$SSP = -K\left[\log \frac{R_{xo}}{R_t} + 2 \log \frac{S_{xo}}{S_{we}}\right] \qquad (22)$$

Equation (22) is the modified Archie formula and should be considered fully valid for clean rocks of intergranular porosity since no other assumption has been made besides those already implied by the original Archie formula.

In a water-bearing formation, $S_{we} = 1.0$ and $S_{xo} = 1.0$, hence, (22) becomes:

$$SSP = -K \log \frac{R_{xo}}{R_o} \qquad (23)$$

Judgment may be passed on the various shaly sand interpretation proposals by comparing them to formulae (22) and (23).

**Gulf Research Publication.** An early suggestion of Patnode and Wyllie[6] proposes to explain the behavior of shaly sands by introducing the concept that clay particles are "conductive solids." This concept is presently well nigh discarded as clays are neither solid nor conductive per se. Wyllie himself tacitly discarded the concept by a new proposal of Wyllie and Southwick[11] using the formula:

$$PSP = -K \log \frac{R_{xo}}{R_o} \qquad (24)$$

This is singularly similar to (23) (PSP being substituted for SSP) and may only be correct in a water sand whether clean or shaly. In an oil sand the use of Equation (24) is still advocated by Wyllie hoping for compensation of a reduced actual SP and PSP due to the presence of oil, thereby allowing to neglect a term such as the second in (22). To further allow for a reduced SP because of the presence of oil, a value of 65 is suggested for K, regardless of formation temperature.

The interpretation technique is then to solve for $R_o$

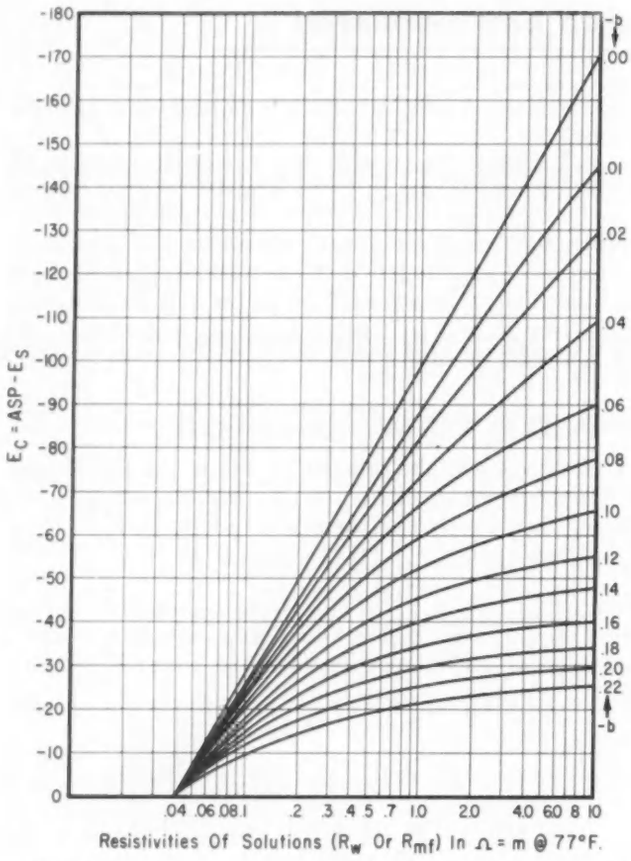


**FIGURE 13—Shaly sand interpretation chart for the determination of "b" shell method.**

(Courtesy: Shell Oil Company)

from (24) after obtaining $R_{xo}$ from a microtool and using the actual SP (ASP) instead of PSP. Then water saturation is obtained from Archie's formula (18).

In the main, the Gulf Research suggestion is unsatisfactory especially in shaly oil sands for a true value of $R_o$ is not obtained and only a fictitious total water saturation without breakdown (bound and mobile) is obtained. Well productivity, as in all other published techniques, is inferred by empirical guessing.

**Humble Research Publication.** Perkins, Brannon, and Winsauer[8] suggest using:

$$ASP = -0.11\ (460 + t_f) \log \frac{R_{xo}}{R_o} \qquad (25)$$

This formula postulates that K at 78° F. is only 59.4.

The only difference from the Gulf Research technique is in the temperature adjustment of the K factor and in the statistical and graphic treatment of the data. The technique is empirical and leaves much to be desired from a quantitative and comprehensive standpoint. It consists in plotting $R_{xo}/R_t$ on a logarithmic scale versus actual SP on a coordinate scale. Proximity of the points to a water line as given by (25) is the deciding factor on whether water or oil production will be obtained.

**Continental Oil Company Research Publication.** The old concept of de Witte[2] that "the conductivity of clay-brine solutions can be represented by a mixture of electrolytes" has been discarded by its author and replaced by a set of equations not unlike the modified Archie Equation (22) derived above, but arrived at by pyramiding many assumptions. De Witte suggests for clean sands:

$$ASP = -K_t \left[ \log \frac{R_{xo}}{R_t} + 2 \log \frac{S_{xo}}{S_{wc}} \right] \qquad (26)$$

and for shaly sands:

$$ASP = -K_t \left[ \log \frac{R_{xo}}{R_t} + \log \frac{S_{xo}}{S_{wc}} \right] \qquad (27)$$

It is suggested that $K_t = 0.21\ T_f$ where $T_f$ is formation temperature in °R. The range of values of $K_t$ is then 61.5 to 85. De Witte's formula (27) for shaly sands tacitly assumes a saturation exponent of 1.0 and its range of applicability is between fully developed SP and a reduction factor of 50 percent. Hence, it is not applicable to shaly sands with very little SP deflection which are actually the cases of greatest interest.

**Halliburton Research Laboratory Publication.** A paper by W. E. White[10] proposes the following equation for shaly sands:

$$ASP = -0.11\ (460 + t_f) \left[ \log \frac{R_{xo}}{R_t} + 2.15 \log \frac{S_{xo}}{S_{wc}} \right] \qquad (28)$$

This formula is very similar to the Archie modified formula (22) except for the K factor value (K = 59.4 at 78° F.) and the use of actual SP instead of SSP. The coefficient 2.15 is introduced in the derivation because the saturation exponent is assumed to be 2.15. The shale effect is present in this formula only inasmuch as the reduced SP (because of shalyness) is used in the derivation. In effect, this is increasing the K factor of the SP formula by $\left(\frac{1}{\alpha}\right)$ where $\alpha = \frac{PSP}{SSP}$. This may not be too objectionable but White's formula breaks down when $\alpha$ approaches zero.

**Schlumberger Research Publication.** A paper by Poupon, Loy, Tixier[9] offers the most generally publicized solution to date to the shaly sand interpretation problem, which solution is based on the following equation:

$$PSP = -70.7 \frac{T_f}{538} \left[ \log \frac{R_{xo}}{R_t} + 2\alpha \log \frac{S_{xo}}{S_{wc}} \right] \qquad (29)$$

in which a full range of shalyness is possible when $\alpha = 0$ for shale and $\alpha = 1$ for clean rocks. In the latter instance, the formula reverts to the modified form (22) of Archie's formula.

The solution of (29) requires, in addition to the availability of conventional logs and micrologs, a knowledge of the SSP from nearby clean sands or a computed value of SSP from dependable formation water sample data.

A convenient chart (Schlumberger Chart $D_4$) for the solution of Equation (29) has been provided by the authors and means for a breakdown of the total water into bound and mobile water is implied but not explicitly claimed. In fact, the theory is valid only for sandwich type shaly sands and the water saturation computation gives that of the clean part of the formation. Another convenient chart (Schlumberger Chart $D_6$) is provided for the determination of porosity.

**Shell Oil Company Research Publication.** A paper by Hill and Milburn[4] offers a distinctly different approach from those previously discussed. Like the method which will be proposed later on in this study, it places

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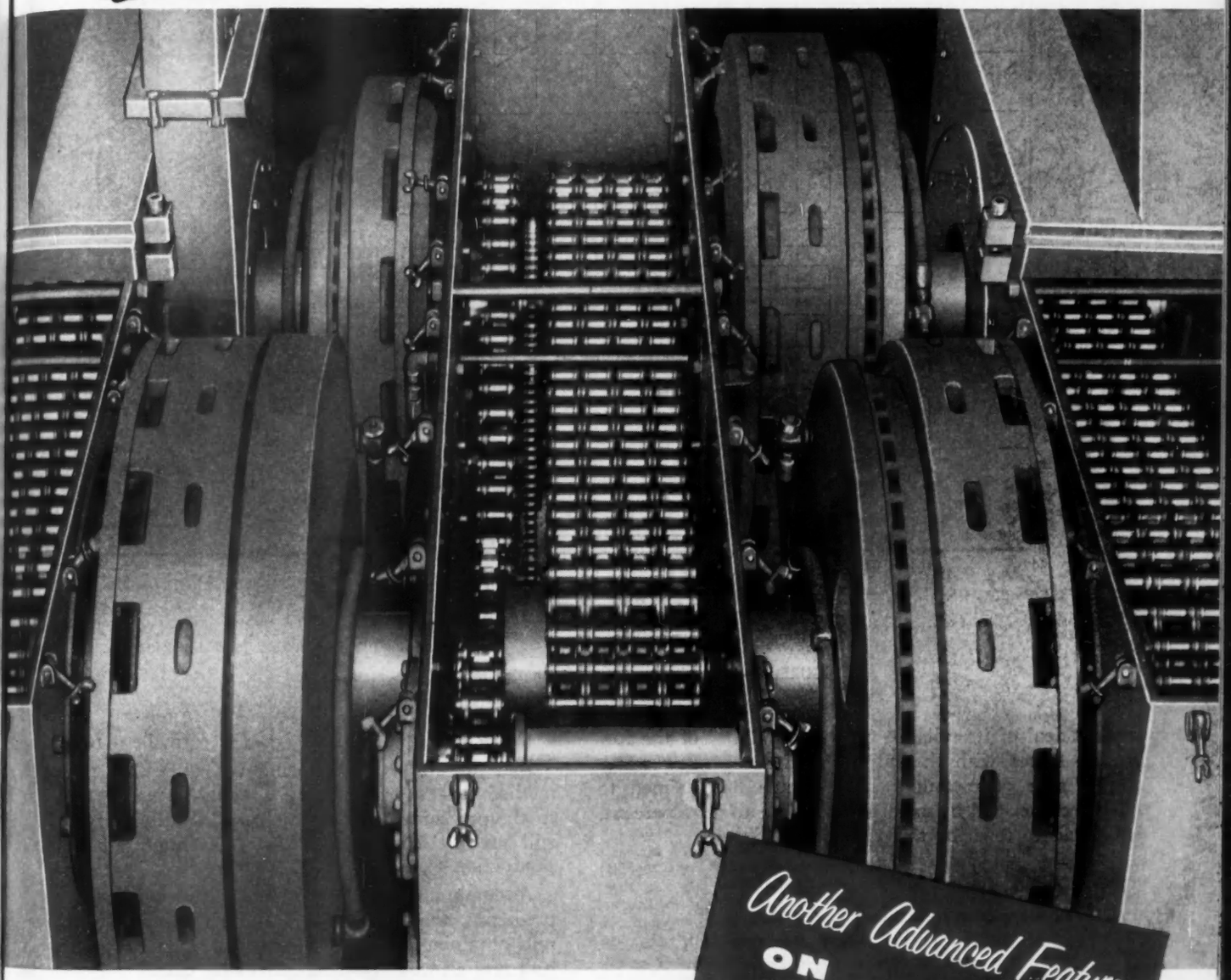

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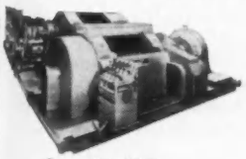

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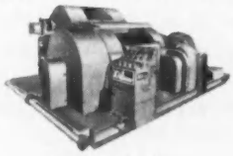

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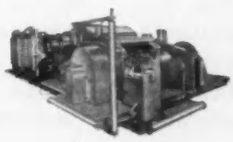

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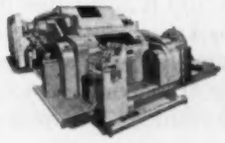

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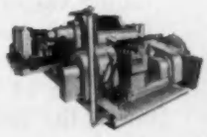

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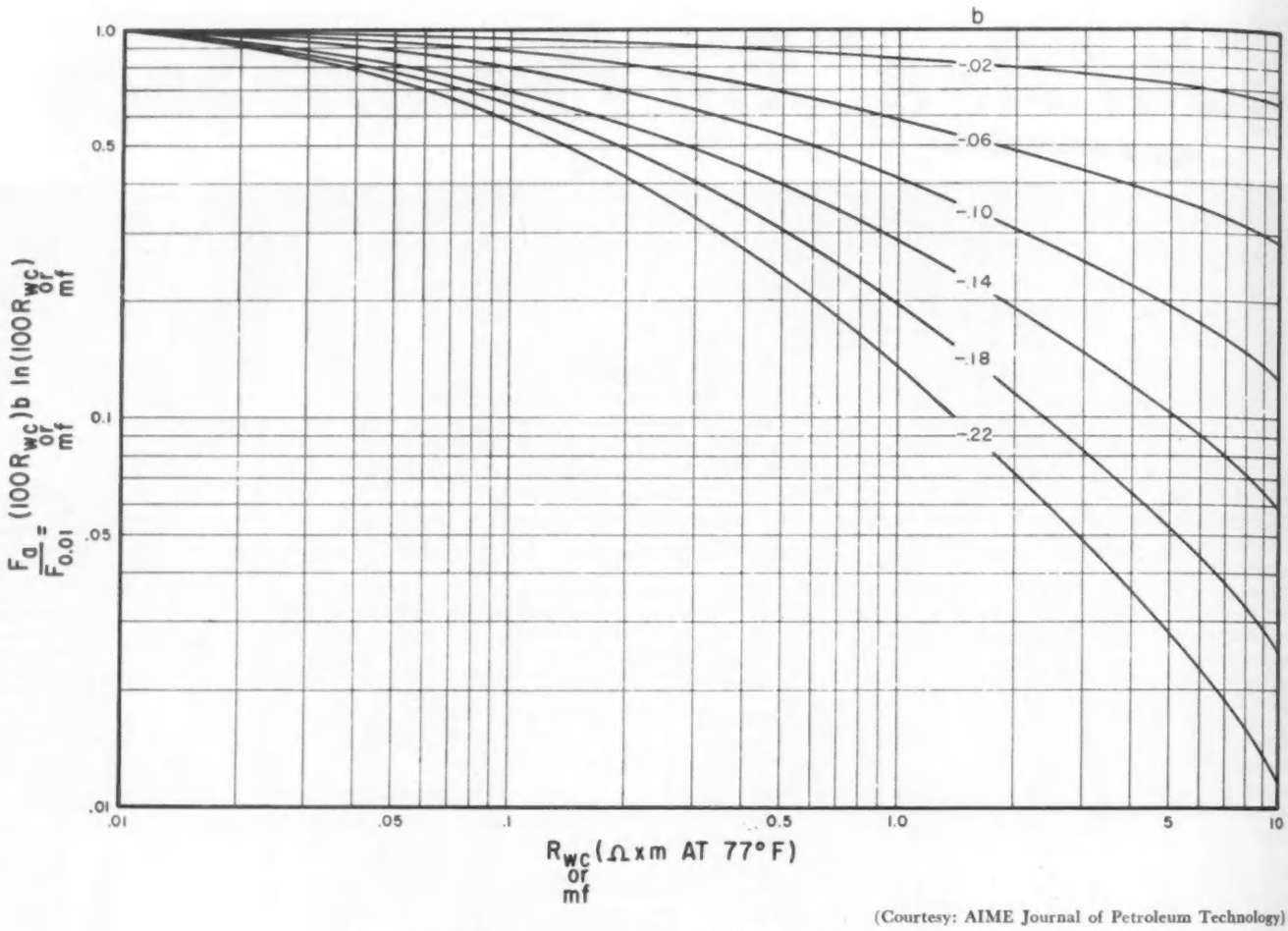



(Courtesy: AIME Journal of Petroleum Technology)

**FIGURE 14—Determination of true formation factor (Shell method).**

a great deal of its reliance on the variability of the formation factor with the salinity of the saturating water at the time of measurement. Formula 30, claimed to have been verified by experimental data to ± 1 percent, is offered to describe this variation:

$$F_a = F_{0.01} (100\ R_{wc})^{b \ln (100\ R_{wc})} \qquad (30)$$

where

$F_a$ is apparent formation factor at $R_{wc}$

$F_{0.01}$ is formation factor when $R_{wc} = 0.01$ ohm × meter. It may also be considered in many instances as the true formation factor: $F_t$

b is a coefficient which characterizes the degree of shalyness of the formation. It has been shown to be related to its base exchange capacity and to the SP supression.

The chart of Figure 13, modified from the original version of Hill and Milburn shows a relation by which the value of b may be obtained provided a valid shale base line may be selected. Preferably it should be determined from Mounce potential tests in the laboratory on formation samples. In their absence, an average shale line may perhaps be selected. By appropriate reduction, the observed SP is corrected for formation temperature and also for bed thickness and true resistivity. Then by interpolation of the corrected SP deflection at the prevailing values of $R_{mf}$ and $R_{wc}$, a value of b is read from Figure 13. Since $F_a$ is known from microtool interpretation, the true formation factor $F_t$ is computed by means of Figure 14 and the true porosity $\phi_t$ is obtained from one of the accepted formulae. The total water saturation is then computed by the Archie or equivalent formula.

Like in all previous techniques discussed, the Shell method falls short of being a comprehensive approach to the problem of ascertaining well productivity; this is still left to the educated guess of the interpreter or to a production test.

A comprehensive interpretation procedure requires predicting the productivity of the formation which entails obtaining values for specific and relative permeabilities and effective pay. Approximate values must also be obtained for the reservoir fluid properties such as oil, gas and water viscosities, fluid densities, and reservoir volume factors. Of course, these properties may not be obtained from the log but from production data from neighboring wells. Termination of the log evaluation should be an estimate of recoverable oil and/or gas according to the expected prevailing driving mechanism.

**A New Technique of Shaly Sand Interpretation.** The shortcomings of the methods previously discussed are their empirical nature or the empirical way in which well productivity is inferred from the results. A more positive answer and breakdown of the total water saturation into bound and movable water is desirable. The new technique of shaly sand interpretation provides this information which is required for well productivity forecast.

The following postulates are made and have been experimentally verified:

$$\text{First postulate: } F_t R_{we} = F_a R_{wa} = R_o \qquad (31)$$

Formula 31 is Tixier's intuitive generalization for $R_o$ as applied to fully water saturated shaly sands. It has received a certain degree of field confirmation and Wyllie presumably gave a speculative proof of it.

$$\text{Second postulate: } F_t = F_a\left[1 - \phi_h + \phi_h \frac{R_{mf}}{R_{we}}\right] \qquad (32)$$

in which $\phi_h$ is the fraction of pore space occupied by the hydration layer of the clay particles. Formula 32 presumes that after mud filtrate invasion in a shaly sand, ionic diffusion from the bound water (or water absorbed by the clay particles) to the mud filtrate does not take place. Hence, the bound water has a salinity substantially identical to the original connate water. Formula 32 is presumed valid for the invaded zone and implies that the hydration layer which envelops the clay particles retains its original connate water salinity ($R_{we}$).

The following derivation is then made:

$$PSP = -K \log \frac{R_{mf}}{R_{wa}} = -K \log \frac{R_{mf}}{(F_t R_{we})/(F_a)} = -K \log \frac{R_{mf}}{R_{we}} \cdot \frac{F_a}{F_t}$$

or:

$$PSP = -K \log \frac{R_{mf}}{R_{we}} - K \log \frac{F_a}{F_t} = SSP - K \log \frac{F_a}{F_t} \qquad (33)$$

or:

$$SSP\,(1-\alpha) = K \log \frac{F_a}{F_t} = -(1-\alpha)\, K \log \frac{R_{mf}}{R_{we}}$$

or:

$$\frac{F_a}{F_t} = \left(\frac{R_{we}}{R_{mf}}\right)^{1-\alpha} \qquad (34)$$

From (34) and knowing $R_{we}$, $R_{mf}$ and $\alpha$, $F_a/F_t$ is calculated. Solving (32), the fraction of pore space ($\phi_h$) occupied by bound water is obtained.

The total water saturation ($S_{we}$) is obtained by solving the usual Archie equation using a saturation exponent of 2.0:

$$S_{we} = \sqrt{\frac{F_t R_{we}}{R_t}} \qquad (35)$$

The results of equation (35) are somewhat pessimistic when the shaly sand is oil-bearing; for in such an eventuality the value of the SP deflection, even when corrected for the usual factors, does not include the SP reduction factor caused by the presence of oil alone.

### Example of Log Interpretation in Shaly Sands

### EXAMPLE III

Example log of Figure 15 is from the Frio sand, Fulton Beach field, Aransas County, Texas. This area is notorious for the shalyness of its producing horizons which are characterized by highly reduced SP deflections. The interval of interest is 7077-7083 feet, or for only six feet of pay. The actual SP deflection is only —20mv, whereas, the computed static SP at that formation level and for the known water salinity should be —69mv. The SP reduction factor is, therefore, $\alpha = \frac{20}{69} = 0.29$. Other pertinent log analysis data are recorded in the tabulation (Table 3).

The various shaly sands interpretation procedures will be reviewed in more detail.

The Schlumberger shaly sand technique (Charts $D_4$ and $D_6$) gives $R_{xo}/R_t = 1$. The total water saturation at intersection of $R_{xo}/R_t = 1$ and ASP = —20mv on Chart $D_4$ is 70 percent. When reduced for static SP of —69mv, the water saturation is found to be 28 percent. While the Schlumberger technique was established for laminated clean sands and shales indicating that

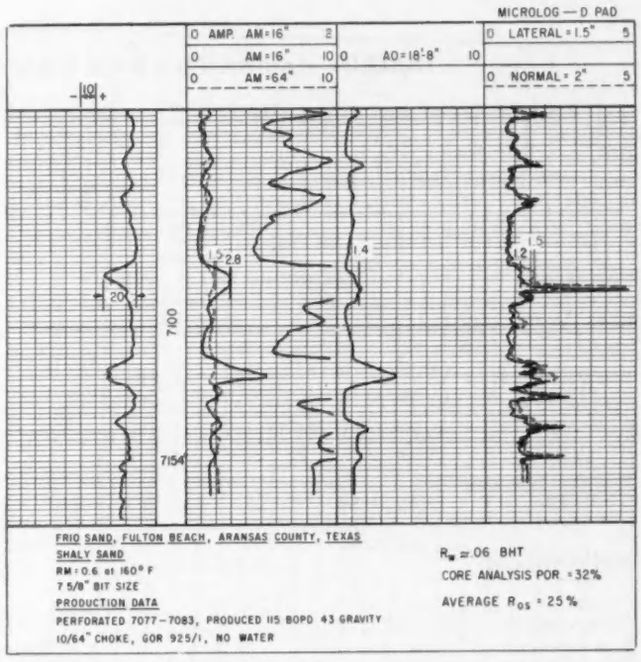



**FIGURE 15—Shaly sand example log taken in an area noted for the shalyness of the producing formation and characterized by reduced SP.**

28 percent would be the water saturation of the clean part of the reservoir, the extension of the technique to sands containing dispersed clays such as in this case is deemed to give, within reason, the free water saturation not bound to the clay particles. On this basis it is concluded that the sand would produce oil, although no provision is made in the technique to give an estimate of productivity and water-cut. Calculating the porosity by Chart $D_6$, one finds $\phi = 24$ percent which is somewhat lower than core analysis results of 32 percent.

The Shell method gives the following results. The static SP at a temperature of 78° F. for which Chart of Figure 13 is computed, is —69mv. The actual SP of the log at the same temperature would be —18mv. The water resistivities involved at 78° F. are $R_{mf} = 0.92$ and $R_{we} = .122$. By interpolating on Figure 13 in order to find a "b" factor that will give —18mv rather than a —61mv between the water resistivities $R_{mf}$ and $R_{we}$, it is found that b = —.17. By making use of Figure 14, one finds $F_a/F_{0.01} = 0.22$ and $F_t/F_{0.01} = 0.7$. $F_a$ is the apparent formation factor obtained from the microlog and, therefore, it is measured when containing mud filtrate. It computes $F_a = 2.8$. Hence, $F_t = 8.9$ which is the true formation factor that would be obtained when measured with connate water. From $F_t$, the true porosity computes to be $\phi = 29$ percent. The total water saturation computes to be by Archie's formula: $S_{we} = 48.8$ percent. The Shell method does not offer as such a means of evaluating a breakdown into bound and free water. This, however, may be done by formulae (32) and (35), giving 37.5 percent bound water and 11.3 percent free water. The results of the Shell method per se could also be extended to well productivity predictions as will be done with the new shaly sand method.

This new technique gave an apparent formation factor of $F_a = 2.8$ using ROS = 25 percent. From equation (34)

$$\frac{F_t}{F_a} = \left(\frac{.06}{.42}\right)^{-(1-.29)} = 3.98$$

the true formation factor is found: $F_t = 11$ which corresponds to a porosity $\phi = 26$ percent. The water of hydration is obtained by equation (32).

$$\frac{F_t}{F_a} = 3.98 = 1 - \phi_h + \phi_h \frac{.42}{.06} = 1 - 6\phi_h$$

and $\phi_h = 49.6$ percent.

The total water saturation by Archie's formula is found to be $S_{we} = 54.2$ percent. The movable or free water is, therefore, only 4.6 percent. The permeability estimated from tortuosity-permeability correlation (Figure 4) is 200md and productivity calculations indicate clean oil production, as indeed it was.

### EXAMPLE IV

Example log of Figure 16 is from Plaquemines Parish, Louisiana. The level of interest is 9500-9533 feet in which the SP de-

*Table 3 on Page 180; Text Continued on Page 183*

## TABLE 3—Log Analysis Data Sheet for Comprehensive Formation Evaluation

Well: Fulton Beach — Date: March 1st, 1957

Aransas County, Texas — Interval: 7077–7083 — e: 6 — Formation:

d: 7⅞ — BHT: 160 — tr @ level: 160 — $R_m$ @ BHT: 0.6 — $R_m$ @ tr: 0.6 — $R_{mf}$: 0.42 — $R_{mc}$: 0.89

θm: — pH: — Filtration loss: — cc/30 min; BH Mud P.: — SIP — △P:

**Determination of $R_{we}$**

Catalog Salinity: — eq. NaCl ppm, ASP: — 20 mV. SSP= — 69 mV @ calculated: $E_r$ = — $mV_{obs.}$ / $mV_{calc.}$ (or calculated)

$E_c$ = — 69 mV; K = 80; $R_{mf}/R_{we}$ = 7; $R_{we}$ = 0.06 or — ppm eq. NaCl

**Determination of Porosity (also $R_{xo}$, $F_t$)**

**From Microtool:** $R_1$ s: —, 1.2, —; $R_2$ = —, 1.5, —; ROS= 0 — ROS= 25% — Core Check

Pad Type: D — $R_{1.5}/R_{mc}$: —, 1.35, —; $R_2/R_{mc}$ = —, 1.69, —; $F_a$ = 5.3, —, —; $F_a$ = 2.8, —, — F=

$e_{mc}$: log: ½ — $R_{xo}/R_{mc}$: —, 2.5, —; $R_{xo}$ = —, 2.22, —; Ø = 38, —, —, Ø = —, —, —Ø= 32%

Caliper: — Empirical Chart: Ø: —, 32, — F: —, —, —

**From Short Investigation Tool:**

**Short Normal:** AM/d = — Limestone 32″ — ROS = 0 — ROS= —

$R_{AM}$ = — R32″ = — $d_e$ = — F = — F = —

$R_{AM}/R_m$ = — $R32/R_m$ = — $R_t/R_m$ = — Ø= — Ø= —

**From Microlaterolog:**

ROS = 0 — ROS = —

$R_{m11}$/ =—, —, —; $R_{xo}/R_{mc}$=—, —, —; F=—, —, —; F =—, —, —

$R_{m11}/R_{mc}$ =—, —, —; $R_{xo}$ =—, —, —; Ø=—, —, —; Ø =—, —, —

**From Neutron Curves:** Conv: Ø= — $F_c$ = — Micro Neutron: Ø: — $F_c$ =

**Shaly Sand Techn:** Schl. α = 0.29 — $R_{xo}/R_t$ = 1.0; $F_a$ = 2.8 — ROS = 25% — Ø= 24%

Shell $F_t$ = 5.6 — Ø$_t$ = 37

Pirson: $F_t$ = 11.0 — Ø$_t$ = 27

Final: Ø = — Values: = $F_t$ = —

**Determination of $R_t$**

**Conventional Log:** Direct Reading: $R_t$ = 2.25 from 64″ log @ 7080: by — rule. $Rt_{corr}$ = 2.25

Departure Curve: $R_{sh}$ = — @ —

$R_{xo}$ = — x 1/($R_{sh}$ or $R_m$) = — $R'/R_{sh}$ = — R′ = — R′/$R_m$ = — $D_i/d$ = — $R_i/R_m$ = —

$R_{in}$ or $_{sl}$ = — " = — " = — " = — " = — " = — $R_t/R_m$ = —

$R_t$ = — " = — " = — " = — " = — " = — $R_t$ = —

**Focussed Logs:** Induction log (— ″): — Laterolog (— ″) or Guard: — Final $R_t$ = 2.25

**Determination of $S_w$**

**Archie:** $R_o$ = — From log @ —; $R_o = F_t \times R_{we}$ = 0.72; $R_o/R_t$ = 0.32 — $S_w$ = 54.2

**Tixier (R.M.):** $R_{xo}/R_m$ = —; $R_i/R_m$ = — $R_i/R_t$ = — $S_w$ = —

$R_i/R_m$ = —; $R_t/R_m$ = — x $R_{mf}/R_w$ = — Ø= —

**Focussed Logs:** $R_{m11}/R_{11}$ = $S_w$ = —

**$R_t$ Method:** $R_{xo}/R_m$ = —; $R_i/R_m$ =—; $R_{mf}/R_w$ =—: a = — $S_w$ = — F =—: Ø=—

**Shaly Sand:** Schl.: $R_{xo}$ = 2.22 — $R_t$ = 2.25; $R_{xo}/R_t$ = 1.0 — $S_{wt}$ = 70% — $S_{wm}$ = 28%

Shell: b = —.11 — $F_t/F_a$ = 2.0 — $F_t$ = 5.6 — Ø$_t$ = 37 — Ø$_h$ = 16.6 — $S_{wt}$ = 38 — $S_{wm}$ = 21.4

Pirson: α = 0.29 — $F_t/F_a$ = 3.98 — $F_t$ = 11.0 — Ø$_t$ = 27 — Ø$_h$ = 49.6 — $S_{wt}$ = 54.2 — $S_{wm}$ = 4.6

**Determination of Permeability (K, $k_r$, and $Swi_{clean}$)**

$t^2 = F\text{Ø}$ = 3.5; K = 200 md; $\frac{850{,}000}{API^\circ} - 3.5H'$ = —, $\frac{R^2_{we}}{F\,R_o\,R_{ti}}$ = —, K = — md Core Check: K = — md

**Tixier (Gr)** = △H = —; △R = —; a = $1/R_o \cdot \triangle R/\triangle H$ = — API = — K = — md

**Capillary Rela.:** $S_{wi}$ = —; $K_{md}$: —; **Height above W.T.** = h = — ft; K = — md

act.

$Swi_{clean}$ = 30%; $K_r$:$K_{o_{org}}$ = —; $K_w$ = 0

**Reservoir Fluid Properties**

P est. = — psi; $S_o$ = 925 cu. ft/bbl; Crude API est. = 43 °; βo = — vol/vol; $\mu o_{org}$ = — cps; $\mu_w$ = — cps

**Determination of Well Productivity**

W.O.R. = — bbl/bbl; W.G.R. = — bbl/MCF; Forecast: Oil Test: 115 BOPD

**Forecast of Recovery per Acre-Foot**

Depletion Dr.: D.R. = — bbl; Water Dr.: W.R. = 325 bbl; Segregation Dr.: S.R. = — bbl; Combination: C.R. = — bbl

**Determination of Effective Pay Thickness: $h_e$**

**Gross Pay:** h = by S.P.: 6′ — Short Normal: 6′ — Microtools: 6′ — Neutron: — Core —

Check —

**Effective Pay:** $h_e$: by Inflection — 6′ — 6′ — —

Point: —

Area —

Under S.P. —

S.P. Reduction: —

Final $h_e$: 6′

**Forecast of Ultimate Recovery per Acre**

Depletion Dr.: D.R. = — bbl; Water Dr.: W.R. = 1950 bbl; Segregation Dr.: S.R. = — bbl; Combination: C.R. = — bbl

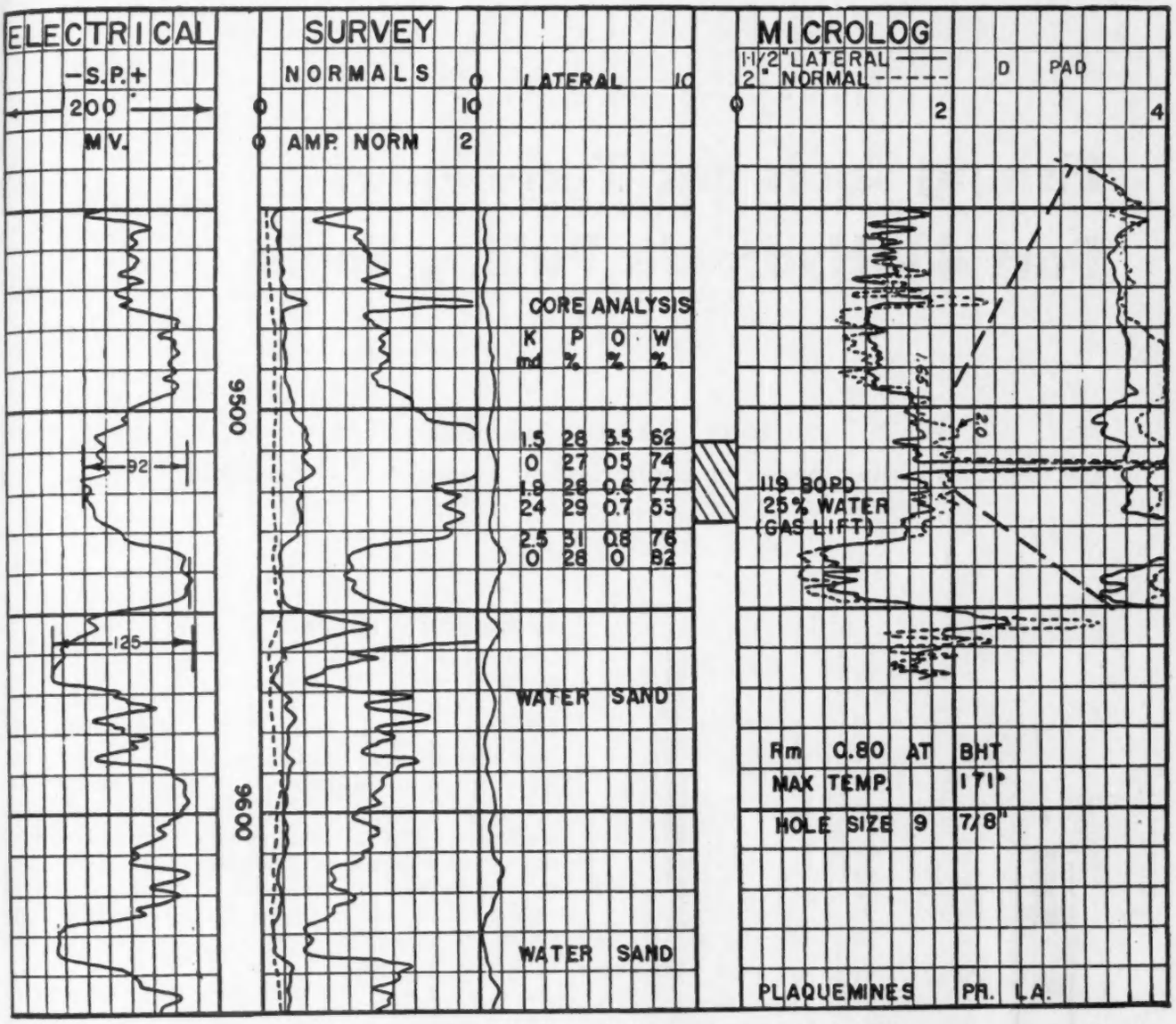



FIGURE 16—This log is from a well in Plaquemines Parish, Louisiana. The level of interest is 9500 to 9533 feet where the SP deflection is obviously reduced.

flection is obviously reduced from —125mv to —92mv. The static SP of —125mv is read in the water sands found at 9560 feet and at 9630 feet. The various shaly sand interpretation techniques reviewed above have been applied and the following tabulation is a summary of the results:

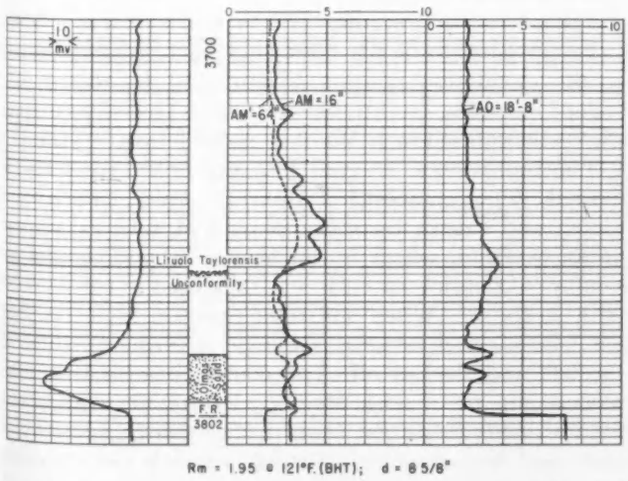



FIGURE 17—Electric log in shaly, glauconitic Olmos sand, Big Foot Field, Frio County, Texas.

TABLE 4

| | Total Water Saturation | Porosity | Bound Water | Movable Water |
|---|---|---|---|---|
| Schlumberger | 56 | 33 | 10 | 46 |
| Shell | 45.5 | 32 | 2 | 43.5 |
| Pirson | 57.7 | 26 | 5 | 52.7 |
| Core Analysis | 70.7 | 28.5 | .. | ... |

On the assumption that the results obtained by the new interpretation technique are the correct ones, inasmuch as they check core porosity most closely, well productivity was calculated on their basis. Using a reservoir volume factor for the oil of 1.5 and identical oil and water viscosities of 0.5 cps, a water-oil ratio of 0.62 was calculated whereas the actual ratio was 0.33. The actual production test made 119 BSTO/Day with 25 percent water.

**Example Log of Figure 17.** Figure 17 is an example log in one of the most shaly, oil producing sands known, namely the Olmos sand of upper Cretaceous age in south central Texas. The example is from the Big Foot field, Frio County, Texas. The sand produces only after formation fracturing when the water block produced by mud filtrate is relieved. There is generally not sufficient invasion to make an interpretation according to the outline given above and as a rule micrologs are not run in this sand. Hence interpretation is altogether qualitative. At this location the Olmos sand produces clean oil even though the water saturation is 65 percent as determined by core analysis.

—The End

# Fishing Tools and Techniques
# Part 4—Hydraulic Pulling Tools

**When 'brute force' is needed in deep wells for recovering liners, packers, pipe, and other pieces of equipment, it is obtained hydraulically.**

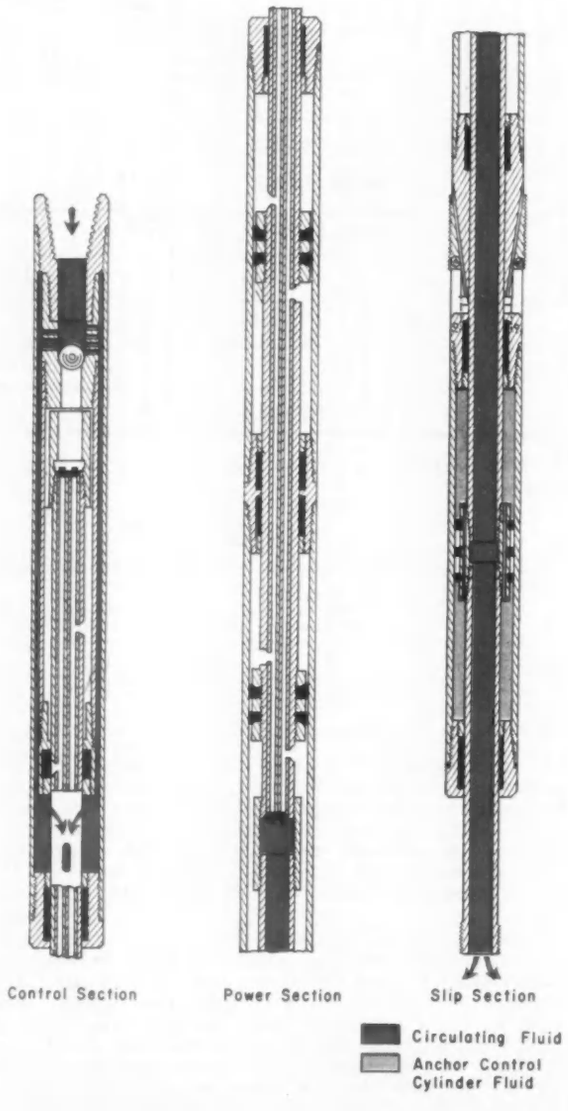



**FIGURE 28—A hydraulic pulling tool in the circulating position. This tool was first run in 1946 and has since received wide acceptance in the industry.**

**By WELDON L. MEDDERS**
Chief Engineer, HOMCO
Houston

PROGRESS IN DRILLING equipment and drilling practices is measured in hours and minutes as well as in feet. As wells are drilled deeper and smaller diameter holes become more popular, the problems of junk and fish recovery becomes increasingly difficult. Below 10,000 feet these problems multiply rapidly. Dog legs, friction losses, pulling suction and hydrostatic pressures all increase with depth so that the forces which were adequate for yesterday's drilling jobs are of little consequence in today's undertakings.

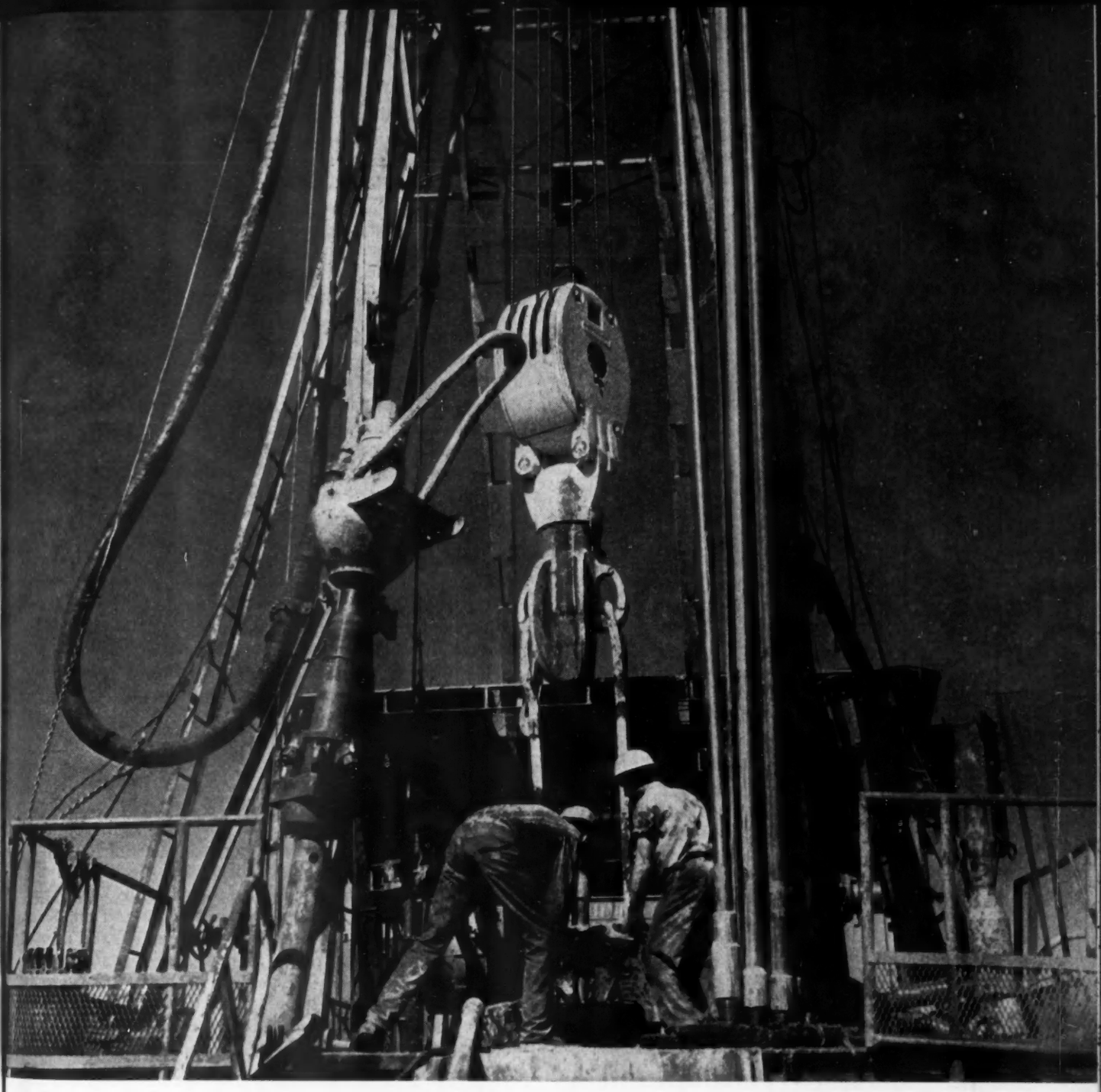
A prime example of brute force in recovery tools is the hydraulic pulling tool (Figure 28). This device was first run at Seabreeze, in December, 1946, and thereafter was widely accepted in the industry for recovering stuck packers and liners.

The operation of the hydraulic pulling tool is simple. It is essentially that of a hydraulic jack, such as one that might be used under a car. Instead of having only one piston it has five or more.

The operating procedure of a typical tool is as follows:

Before going into the hole the tool is securely locked in the circulating position (Figure 29) by means of a collet-type latch. In this position fluid is free to pass from the well bore through the tool and fill up the string.

The tool is then lowered into the hole as rapidly as desired. Upon reaching bottom the stuck fish is contacted and caught by a grappling tool, such as a spear or an overshot, which is run below the pulling tool assembly. (An inside cutter is generally used in conjunction with a spear.) When sufficient upstrain indicates that the fish has been secured, the pipe is torqued lightly to the left and slacked off. The control head is then telescoped into the reverse position (Figure 30) with about 3 to 5 points of weight upon it. The control head operates much like a commercial spool valve. When the outer barrel is moved up and down on the inner stem or spool, various ports are exposed to a pressure chamber, direct-



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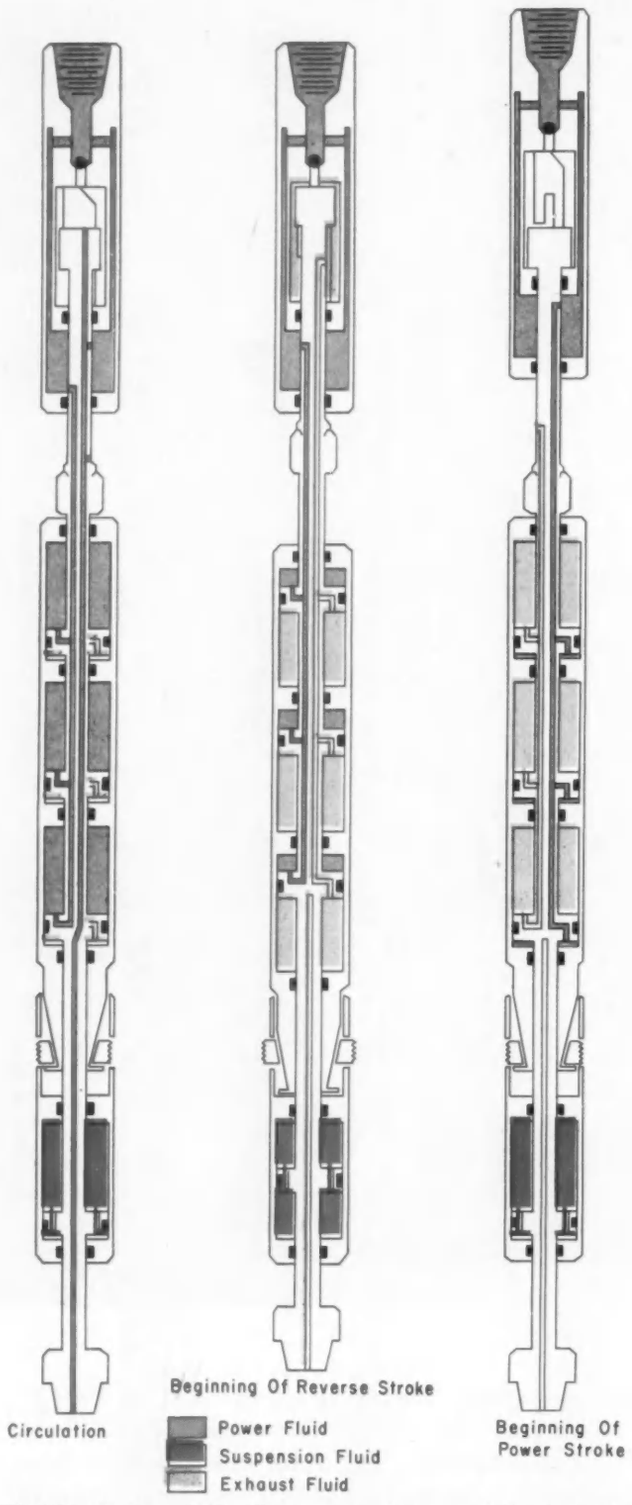


**FIGURES 29, 30 and 31—The operational stages of the five piston hydraulic pulling tool. In Figure 29 the tool is locked in the circulating position. After the fish has been secured, the pipe is torqued to the left and slacked off and the control head is telescoped into the reverse position, Figure 30. After the ball is dropped and the control head is slacked off, left hand torque is applied and the control section pulled up, the tool is then in the power stroke position, Figure 31.**

ing the flow of fluid to either of several desired places. In the reverse position, previously referred to, fluid is directed into the pressure chamber and thence into the reverse port of the power stem, down the piston rods and out into the upper part of the five cylinders, forcing the pistons down and the cylinders up. This is the release position and is the opposite of the pull or power position.

At this point a $1\frac{7}{16}$-inch diameter Bakelite ball is dropped into the string and pumped down at about 500 pounds pressure. When the ball seats in the tool, the pressure rises, since fluid can no longer pass through the center of the tool and out into the annulus.

After the ball seats in the tool, the tubing or drill pipe is pressure-tested.

When the control head or spool valve is slacked off all the way left-hand torque is applied and the control section pulled all the way up, a distance of 19 inches, putting the tool in the power or pull position (Figure 31). In this position fluid passes from the string through the perforated connection and into the pressure chamber in the lower part of the control head. Here the fluid enters the power port of the stem where it moves downward and is diverted to the lower side of each piston, tending to force the pistons up and the cylinders down. Since the pistons are tied, indirectly, to the stuck fish, they resist upward movement. But, the outer cylinder assembly, to which is affixed the slip mandrel, is held only by the 12,000 pound collet-type latch mentioned before. Accordingly, the latch breaks loose under pressure and allows the slip mandrel to move down and set the slips. Once the slips are set the driller is then free to take additional strain on the fish, pulling up as much as is desired to supplement the work of the pull tool itself.

As pressure is increased, fluid continues to enter below the pistons which begin to rise in unison pulling the stuck fish below.

The fish will move upward about 24 inches, then the pumps are shut down, and the control head is slacked off into the reverse position. Pressure is applied and the fluid enters the reverse port of the pull tool stem where it moves downward and is diverted to the top side of each piston. As these chambers begin to fill the outer cylinders begin to move upward pulling the slip mandrel out from under the slips. Once the slips are free of the casing the entire outer cylinder assembly and slip cage are free to move upward the full length of the stroke.

The tool is then ready to make another stroke and the above procedure is repeated. As many strokes may be made as are necessary to pull the fish. In extreme cases the fish may be jacked-up the length of the hole.

After the necessary number of pulls have been made the control head is slacked off into the reverse position and right-hand torque is taken in the string. Pressure is applied and the tool is forced into the "latched-up" position for coming out of the hole. The string is then picked up and the control head falls into the circulating position. Thus the tool is brought out of the hole with the circulation ball remaining in its seat; the fluid draining around through the control cylinder and out through the stem.

Some of the salient features of this tool are:

1. It requires no heavy surface equipment for effective operation; hence it is excellent for workover where light equipment is more adaptable.
2. It can be run on tubing, a fact which further promotes its utility in the workover field.
3. It applies energy at or near the stuck point, relieving rig equipment of strain and eliminating sidewall frictional losses.
4. It permits greater pull on a fish below 10,000 feet,

than can normally be applied with rig equipment.

5. By the addition of power cylinders and pistons, ratios as high as 100 to 1 can be attained. However, this has been found to be unnecessary and accordingly it is not recommended, since, with adequate pressures the tensile yield value of the tool itself is approached.

Table 6 is a chart giving the maximum allowable pull for both 5½-inch and 7-inch tools at various pressures. With only 26,250 pounds upstrain over and above the weight of the pipe from the rig floor, it is possible with the 7-inch tool to exert a pull of 416,640 pounds on the fish. Generally speaking, this is a gain of several hundred thousand pounds over the pull which may reasonably be exerted on a fish using conventional rig equipment. This means that many jobs which formerly required several cuts and as many trips to complete may now be dispatched in one trip with a single surge of pressure from the rig pumps. If a fish is stuck very tightly, it may be necessary to move in a portable high pressure pumping unit to insure that the full potential of the tool will be utilized.

Perhaps the most significant contribution of this tool to the industry has been in the field of remedial work. In time and money it provides maximum economies in the removal of stuck liners and packers.

Prior to 1920, the practice was to run a "bull-dog" spear (Figure 32) and with every ounce of steam in the boiler attempt to pull the liner, packer, and screen in one gigantic effort. Often the derrick splintered instead!

After 1917, bull-dog spears with left-hand threads were introduced, so that, if the liner could not be pulled, the pipe string could be released with right-hand rotation, leaving the spear mandrel and slips in the hole. In a subsequent operation the mandrel and slips were rammed to the bottom of the hole.

If the liner and packer were dislodged in the pulling operation, the precarious business of extricating the packer without swabbing the hole was undertaken. The hazards were sometimes great.

If, on the other hand, the fish could not be pulled and the derrick did not break down, then a dynamiting operation was begun. In the early days the dynamite was wired and placed in an inner tube, both ends of which were drawn up and sealed with tape. The tube was then

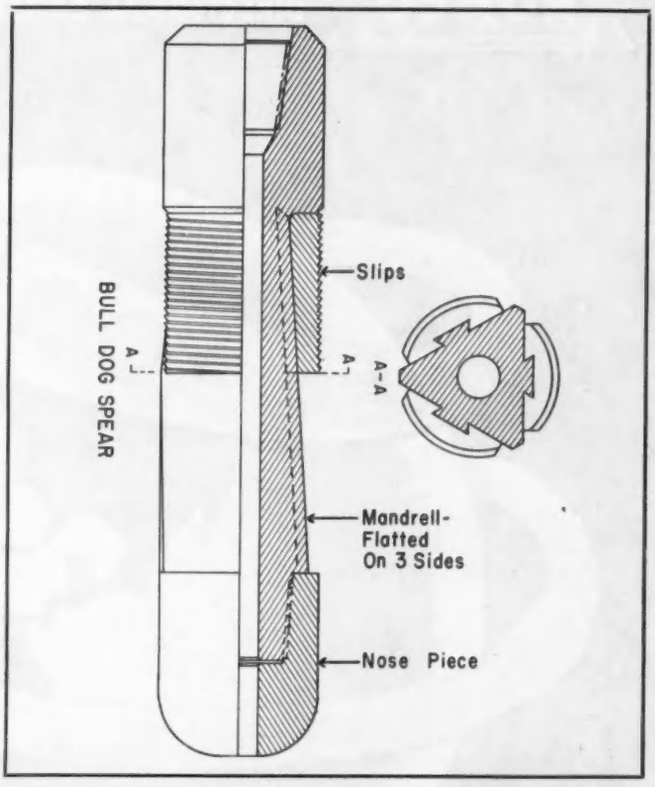


**FIGURE 32—A bull-dog spear used prior to 1920. The use of this tool with a tightly stuck fish imposed a great strain on the surface equipment.**

**TABLE 6—Pull Tool Pressure Chart**

| PRESSURE (p.s.i.) | 5½" O.D. PULL TOOL 4⁹⁄₁₆" O.D. MAXIMUM | | | 7" O.D. PULL TOOL 5¾" O.D. MAXIMUM | | |
|---|---|---|---|---|---|---|
| | Pounds Pull By Pull Tool With 5 Cylinders | Max. Pounds Pull Allowed on Tool With Pressure & Pull on Derrick Above String Wt. | Max. Pounds Derrick Pull Above String Weight | Pounds Pull By Pull Tool With 5 Cylinders | Max. Pounds Pull Allowed on Tool With Pressure & Pull on Derrick Above String Wt. | Max. Pounds Derrick Pull Above String Weight |
| 1,000 | 46,310 | 273,000 | 226,690 | 59,150 | 364,000 | 504,850 |
| 1,200 | 55,572 | 274,800 | 219,228 | 70,980 | 366,000 | 295,020 |
| 1,400 | 64,834 | 276,700 | 211,866 | 82,810 | 368,000 | 285,190 |
| 1,600 | 74,096 | 278,500 | 204,404 | 94,640 | 370,000 | 275,360 |
| 1,800 | 83,358 | 280,400 | 197,042 | 106,407 | 372,000 | 265,593 |
| 2,000 | 92,620 | 282,100 | 189,480 | 118,300 | 374,000 | 255,700 |
| 2,200 | 101,882 | 284,100 | 182,218 | 130,130 | 376,500 | 246,370 |
| 2,400 | 111,144 | 285,900 | 174,756 | 141,960 | 379,000 | 237,040 |
| 2,600 | 120,406 | 287,800 | 167,394 | 153,790 | 381,500 | 227,710 |
| 2,800 | 129,688 | 289,600 | 159,912 | 165,620 | 384,000 | 218,380 |
| 3,000 | 138,930 | 291,500 | 152,570 | 177,450 | 386,500 | 209,050 |
| 3,200 | 148,192 | 293,300 | 145,108 | 189,280 | 389,000 | 199,720 |
| 3,400 | 157,454 | 295,200 | 137,746 | 210,110 | 391,500 | 190,390 |
| 3,600 | 166,716 | 297,100 | 130,384 | 212,940 | 394,000 | 181,060 |
| 3,800 | 175,978 | 298,900 | 122,922 | 224,770 | 396,500 | 171,730 |
| 4,000 | 185,240 | 300,800 | 115,560 | 236,600 | 399,000 | 162,400 |
| 4,200 | 194,502 | 302,600 | 108,098 | 248,430 | 401,500 | 153,070 |
| 4,400 | 203,764 | 304,000 | 100,236 | 260,260 | 404,000 | 143,740 |
| 4,500 | 208,396 | 305,440 | 97,044 | 266,175 | 405,200 | 139,025 |
| 4,600 | ..... | ..... | ..... | 272,090 | 406,500 | 134,410 |
| 4,800 | ..... | ..... | ..... | 283,920 | 409,000 | 125,080 |
| 5,000 | ..... | ..... | ..... | 295,750 | 411,500 | 115,750 |
| 5,200 | ..... | ..... | ..... | 307,580 | 413,500 | 105,920 |
| 5,400 | ..... | ..... | ..... | 319,410 | 416,640 | 97,230 |
| 5,600 | ..... | ..... | ..... | 331,240 | 416,640 | 85,400 |
| 5,800 | ..... | ..... | ..... | 343,070 | 416,640 | 73,570 |
| 6,000 | ..... | ..... | ..... | 354,900 | 416,640 | 61,740 |
| 6,200 | ..... | ..... | ..... | 366,730 | 416,640 | 49,910 |
| 6,400 | ..... | ..... | ..... | 378,560 | 416,640 | 38,080 |
| 6,500 | ..... | ..... | ..... | 390,390 | 416,640 | 26,250 |

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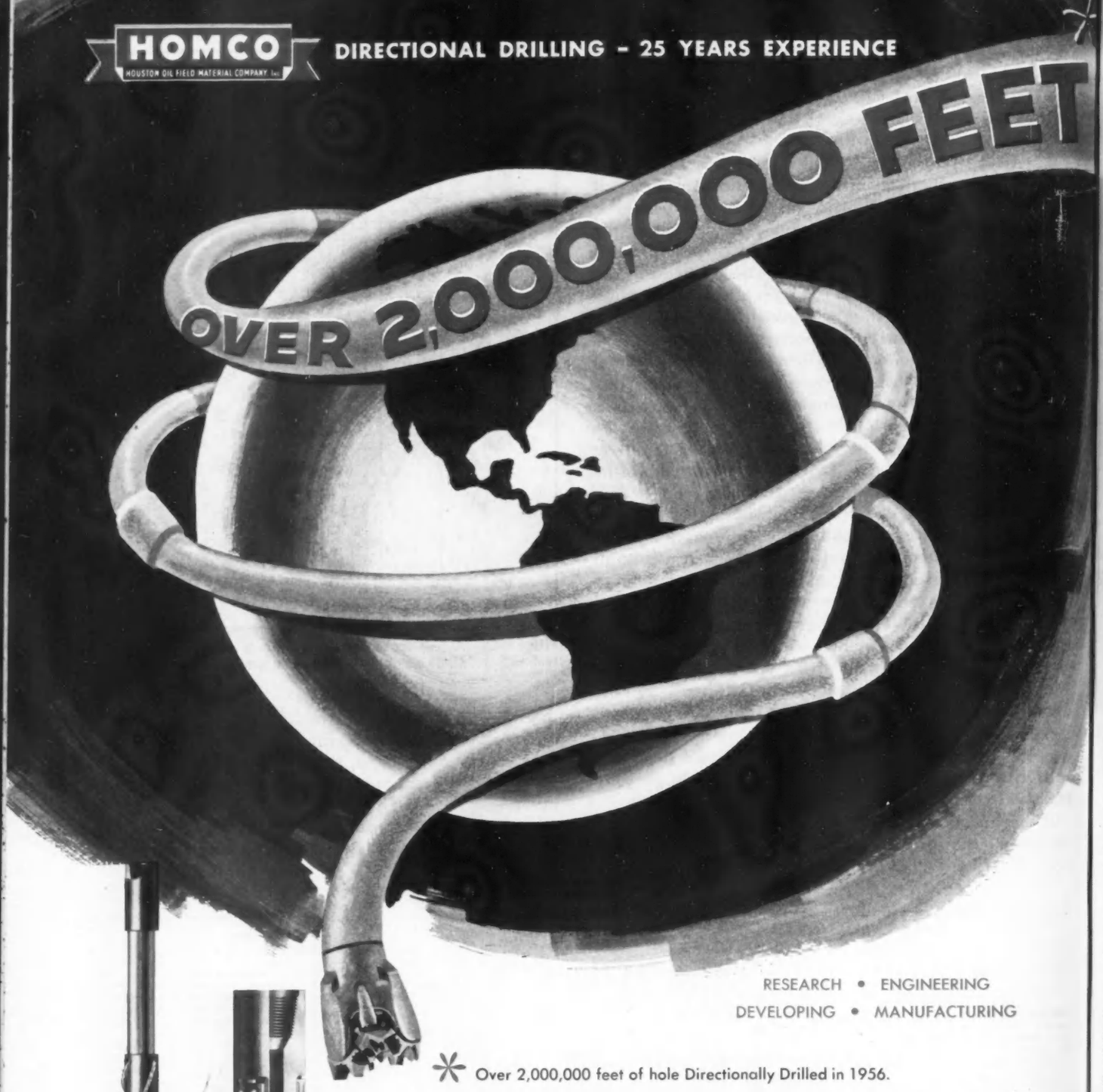


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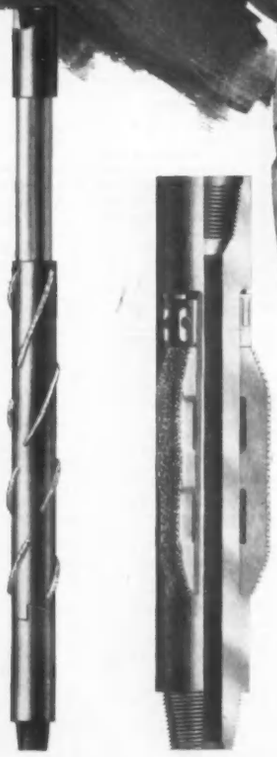

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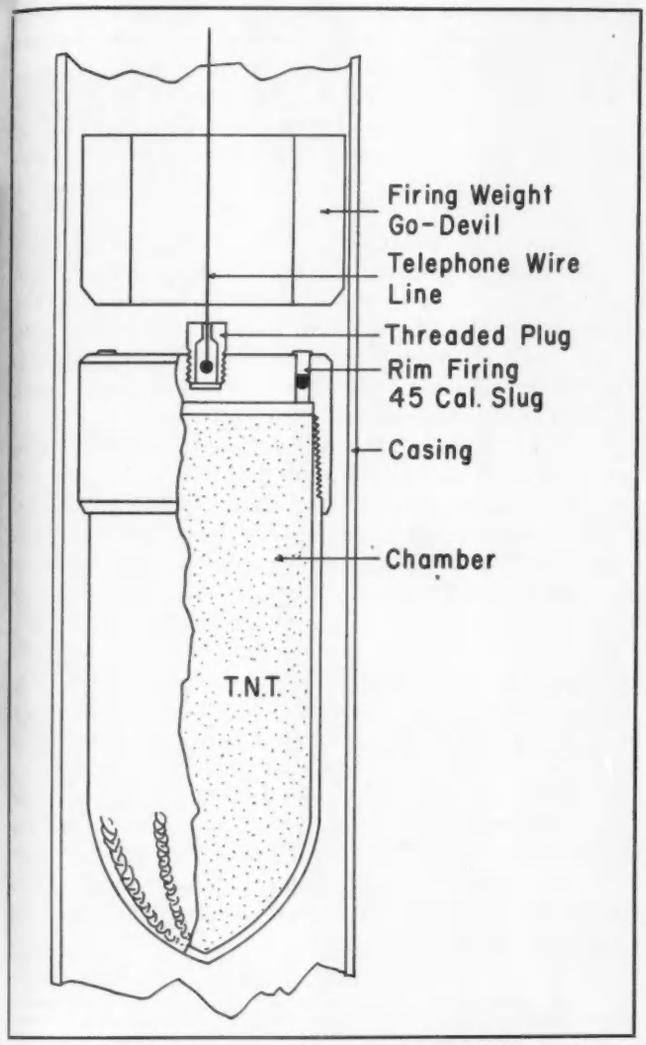



FIGURE 33—A drop shooting device that was exploded by dropping a go-devil onto positioned rim-firing 45 cal. slugs. This was used to rupture the liner or casing to permit sidetracking.

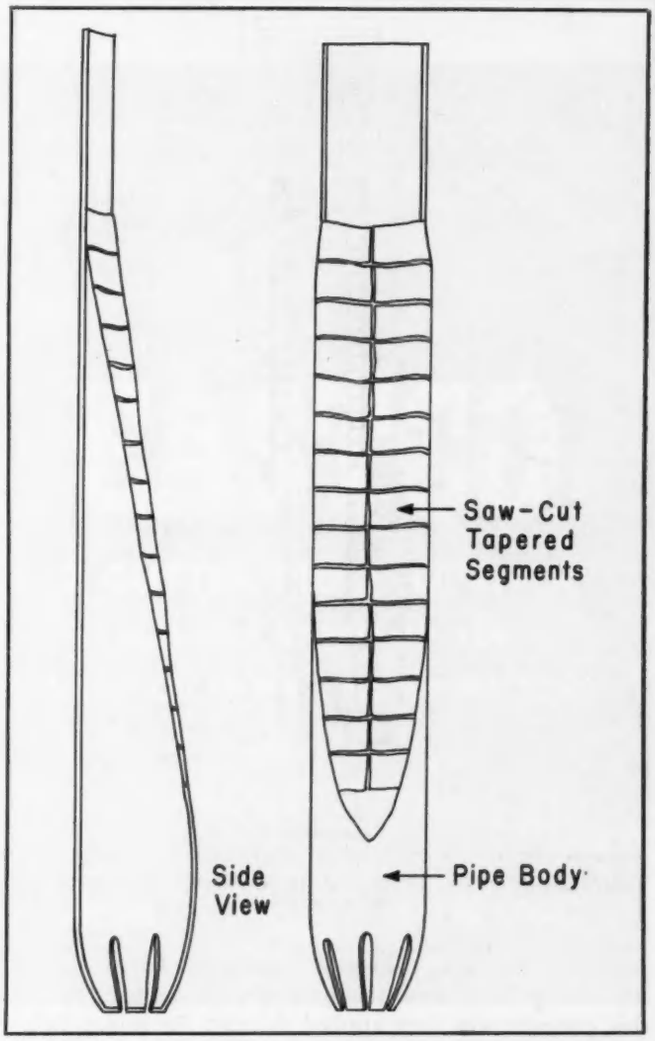



FIGURE 34—A field made, saw-cut whipstock used in the early days to sidetrack. This method was very time consuming and the results were quite questionable.

lowered into the hole on the electrical cable, located the desired depth in the liner, and fired from a battery box at the surface.

Later a refinement known as drop shooting was inaugurated. In this method a piece of boiler flue was orange-peeled on one end and formed into a bullet-nose. The other end was threaded to receive a cap. About five sticks of T.N.T. were loaded into the chamber and the cap was screwed on. Near the rim of the cap were two drilled holes 180 degrees apart into which were fitted two 45 caliber bullets, nose down. This assembly (Figure 33) was then run into the hole on telephone wire and located in the liner below the casing. A piece of pipe of the correct diameter was then go-deviled over the telephone wire and the two 45 caliber bullets were rim-fired. These touched off the T.N.T. blasted a sizable crater around the liner which had split apart and peeled back at the lap weld. Below the split portion, the liner would become egg-shaped, causing the bit to roll off and sidetrack at this point.

If, however, a T.N.T. specialist were not available, whipstocking provided an alternate method. With pioneer ingenuity a homemade whipstock was fashioned out of pipe. Two styles were used!

The first, and more rudimentary of the two, consisted of a piece of pipe about six to eight feet long, flattened at one end and tapering gradually to full round at the other.

The second and preferred style consisted of pipe which was saw-cut on a taper, full round at the lower end and tapered to a spire at the top. A short distance down from the top, where the trough began to deepen, the sides were folded over to give pitch to the face. The bottom or round portion of the stock was of larger diameter than the liner and was often tapered on the end to produce a wedging effect (Figure 34).

In practice, the whipstock was go-deviled to the bottom of the casing where it seated and wedged in the top of the liner. A bit was then run and the hole sidetracked through the casing.

Often it would have been better to move over and drill another hole.

In the '20's, the embryo of a new method came to life in the form of the first friction block inside cutter (Figure 35). It then became possible to go in and cut the packer loose from its "set" position. Subsequently, on another trip of the tubing or drill pipe an attempt would be made to pull the liner with a releasing spear.

Later, it became the practice to run a drill bit, inside cutter, and spear all in the same trip. First, the back

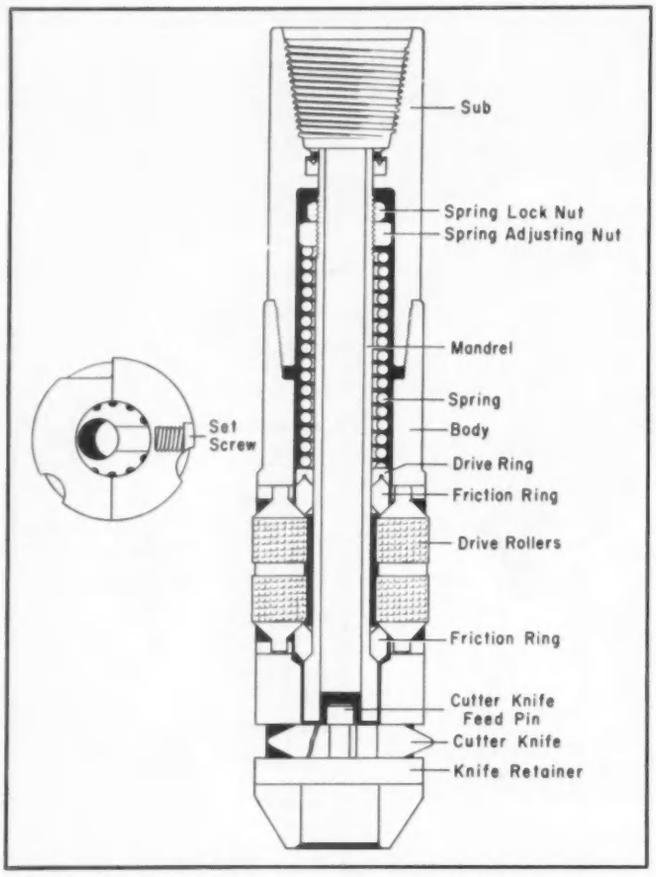



**FIGURE 35—A drawing of the first friction block inside cutters used in the early 1920's.**

pressure valve was drilled to avoid swabbing accidents. An attempt was then made to pull the packer. Failing this, pressure was then applied through the tubing in an effort to pump the packer loose from its setting position. Finally, if this effort was unsuccessful, an inside cut was made and the freed portion of the liner pulled.

Sometimes, in severe cases, it was possible to cut only six inches of the liner at a time, since the workover rig equipment was not capable of pulling any more. This meant perhaps as many as 20 to 30 trips to complete a single job.

The hydraulic pulling tool has written perhaps not the final but at least a climactic chapter in the art of recovering liners and packers. For the present it has just about obsoleted other methods. Run in conjunction with spears, jars and inside cutters, this tool accomplishes in a few days, and sometimes even in a few hours, work which formerly required weeks.

Table 7 is a resume of 11 jobs chosen at random from California files. It is significant that only about one cut was required per job, meaning that in general the pull tool was capable of handling the job with minimum assistance. The average time to complete a job was only two and a quarter days. Using the old method, sometimes cutting and pulling as little as 12 inches at a time, it is safe to say that the average time to complete would have been several times that shown.

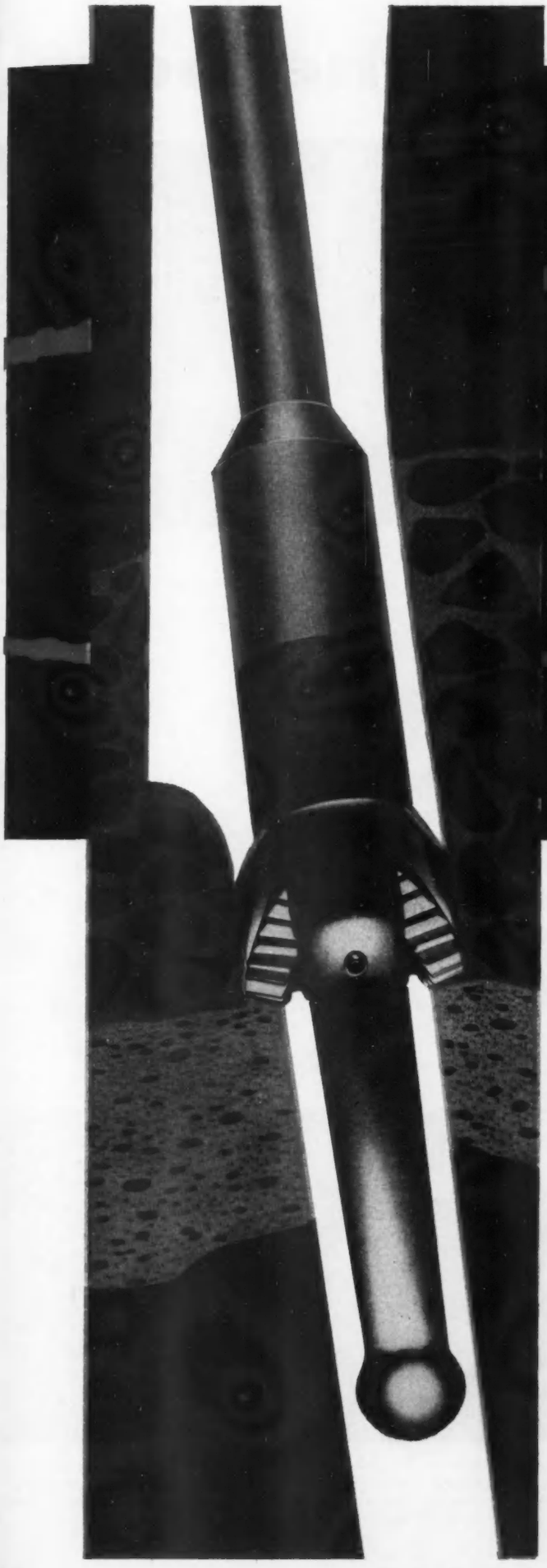
Thus from a little used tool in the late '40's, the hydraulic pulling tool has become first in the tools and methods used for the recovery of stuck liners and packers. Power has paid off. Trips have been halved. The new technology born with the second world war has helped accelerate slow and tedious fishing and recovery jobs. The homemade whipstocks and inner tube depth charges of yesterday have served their purpose and passed into obsolescence.

**EDITOR'S NOTE**

The fifth in this series of six articles will appear in the June issue of WORLD OIL and will present the evolution and present application of a number of the more commonly used fishing tools.

**TABLE 7—Resume of Pull Tool Jobs**

| AREA | Average Depth | No. Cuts Required | No. Trips with Pull Tool | Total No. Trips* | Length of Liner Retrieved | Time in Days to Complete | Maximum Pull in Pounds Required | Remarks |
|---|---|---|---|---|---|---|---|---|
| No. 1 Long Beach | 3100 | 3 | 4 | 12 | 143 Ft. | 3 | 132,000 | Liner stuck inside and out. Required 3 trips with bit to clean out. One trip with washpipe required to recentralize liner. |
| No. 2 Long Beach | .... | 1 | 4 | 4 | 92 Ft. | 1½ | 250,000 | 7"—23 lb. casing with window. 4¾"—16 lb. liner prepacked to 6½". Stripped out of fish twice. Last pull jacked fish 18' and then pulled complete liner prepacked with punch plate screen through window. |
| No. 3 Long Beach | 5159 | 0 | 1 | 1 | 200 Ft. | 1¾ | 294,000 | Jacked liner 200' over 8 hour period before freeing. |
| No. 4 Long Beach | 3105 | 3 | 3 | 6 | 58 Ft. | 3 | 354,000 | 5½"—17 lb. prepacked liner with screen. |
| No. 5 Long Beach | .... | 4 | 4 | 9 | 30 Ft. | 6 | 312,000 | Retrieved only 30' of 500' long 5½" hen skin inside 8⅝" casing perforated and pump-packed with centralizers on liners. It was finally decided that the liner was cemented. |
| No. 6 Huntington Beach | 4763 | 2 | 5 | 9 | 125 Ft. | 3 | 380,000 | 4¾"—16 lb. liner. Cutter and pull tool run separately. One day spent in washing and back-scuddling gravel. |
| No. 7 Long Beach | 2959 | 1 | 2 | 5 | 225 Ft. | 1½ | 242,000 | 5½"—17 lb. liner prepacked to 7". |
| No. 8 Bakersfield | 4907 | 0 | 2 | 2 | 0 | 2 | 228,000 | Fishing out casing scraper and bit about 6' long which had been cemented in. Took 17 hours to come out of hole as blocks in scraper caught at every collar and had to be dislodged with burst from pull tool. |
| No. 9 Long Beach | 3255 | 0 | 1 | 1 | 68 Ft. | ¼ | 145,000 | Pulled 65' of 5½"—17 lb. liner and 3' lead seal hanger. |
| No. 10 Bakersfield | 4696 | 0 | 1 | 1 | 41 Ft. | ½ | 70,000 | 5"—17 lb. liner. |
| Long Beach | 3645 | 0 | 2 | 2 | 380 Ft. | 1 | 192,000 | 5½"—17 lb. liner. Jacked liner total of 230' up hole before coming free. |
| No. 11 Long Beach | 3645 | 0 | 1 | 1 | 380 Ft. | 1¼ | 148,000 | Almost exact duplicate of preceding job. Operation had run same liner back in well and decided to repull. |
| Total | .... | 14 | 30 | 53 | 1742 Ft. | 24¾ | ..... | ..... |
| Average | .... | 1.3 | 2.7 | 4.8 | 158 Ft. | 2¼ | ..... | |



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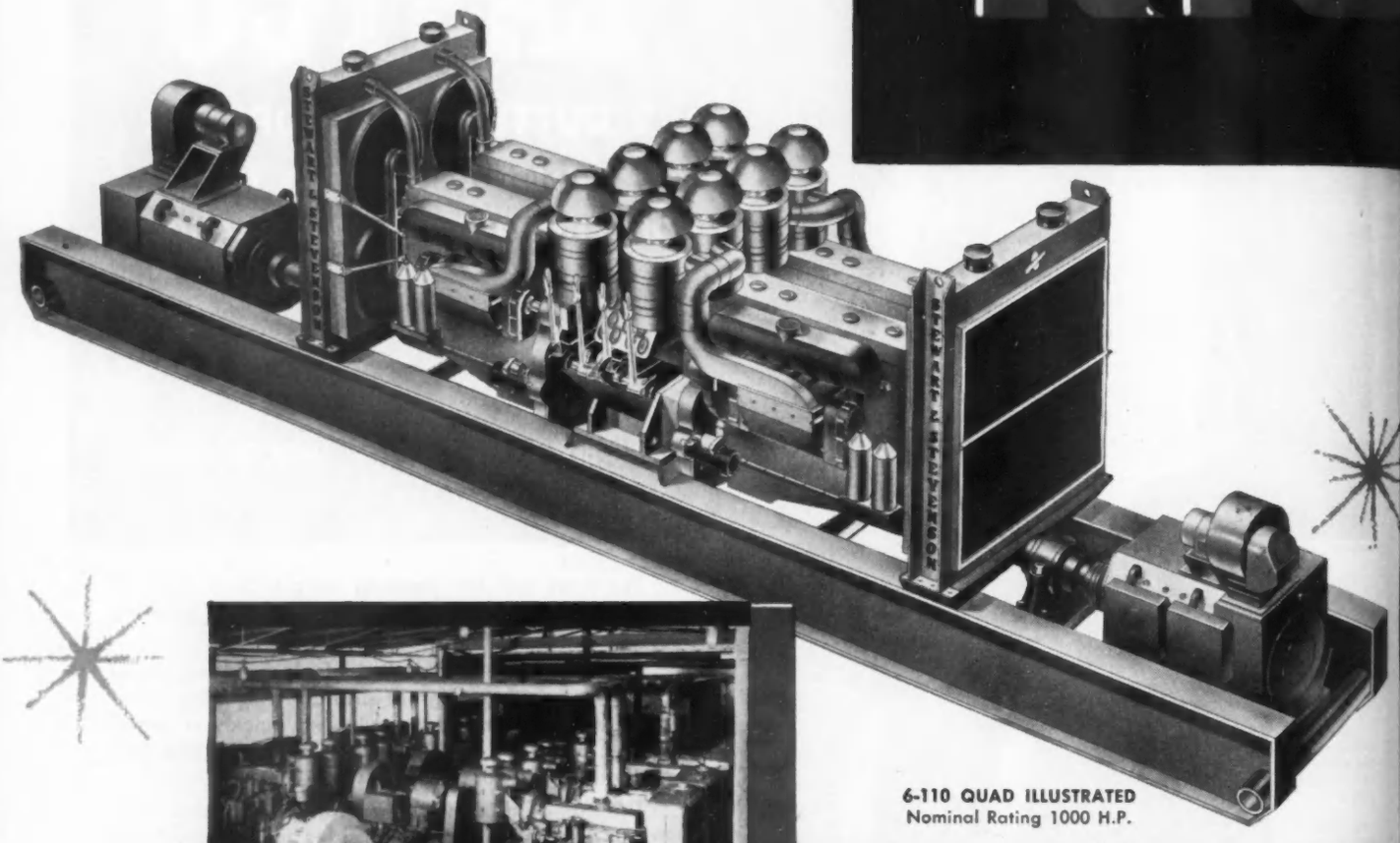

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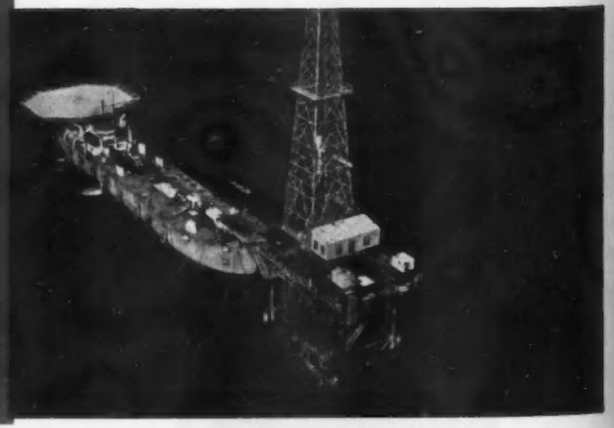

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2. **MULTIPLE ENGINE DEPENDABILITY** — On the Model 24-1000 RIGELECTRIC power packages, four 250 HP engines with a combined capacity of 1000 HP are furnished. With this arrangement, if one engine should be out of service, then the other three combine to give ¾ of the full power into the generators.

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# Rig Safety Meetings Promote Team Spirit

**Frequent safety meetings conducted by crew members keep all hands thinking safety, and working together as careful and efficient team.**

**By JOHN JORGENSEN**
Loffland Brothers Company
Casper, Wyo.

THE MAIN PURPOSE of rig safety meetings is to teach the men to *think*.

Experience has shown that accidents are caused, they don't simply happen. Many accidents are caused by unsafe conditions that are allowed to exist around a rig, such as slick floors, nails projecting in boards and so on. The majority of all accidents, however, are caused by the unsafe acts of the men who get hurt. Practically all accidents can be avoided by eliminating unsafe conditions and by proper *fore*thought and action on the part of the crew members.

On our rigs less than 1 percent of the accidents are caused by equipment or mechanical failure, whereas the other 99 percent are caused by unsafe acts of human failure on the part of the injured. In 1954, less than one-tenth of 1 percent of our accidents were caused by mechanical or equipment failure. With this knowledge there is no doubt as to the value of rig meetings as an instrument to keep safe and efficient practices always before rig personnel. The rig meeting is the backbone of a drilling contractor's safety program. Records show that drillers who regularly hold meetings have fewer accidents, less drilling trouble and do a better over-all job than drillers who do not hold these meetings regularly. This is understandable as these meetings are teaching the men to think and plan their work.

Due to a large turnover of personnel on drilling rigs it is almost impossible to institute and maintain a package program. The rig meetings have to be flexible and seasonal in order to talk about safe and efficient practices that fit the rig, crews, location, type of work in progress and many other factors.

The type and number of meetings vary according to the need and company policy. The type found to be most successful is as follows: Each crew has an informal meeting lasting 15 to 30 minutes once a week. The toolpusher conducts a meeting with each crew once a month. This makes a total of 15 meetings a month per rig as a minimum standard. In the event of an unusual job or work procedures such as gas drilling, DST, running casing, etc., a meeting is held prior to starting work in order to point out all the hazards that are not usually encountered plus explaining work procedures required for the job to be performed.

Rig inspections are held once a month by each crew plus one by the toolpusher. A total of four inspections per month per rig is a minimum standard. These meetings and inspections should be *held,* and not "boiler housed." It is necessary to rely on the integrity of the supervisory personnel.

Subject matter for discussion at these meetings is furnished on a yearly or monthly basis. These are outlined in front of the "Rotary Drilling Handbook on Accident Prevention and Safe Operating Practices." Also safety hints for drilling, published each month by the AAODC; the company monthly accident report; articles furnished by the insurance carriers; Workmen's Compensation Boards, National Safety Council and State organizations literature is also used. A new development that will be of assistance to the industry are the 52 safety meeting topics developed by D.I.S.S.E. If your company has a safety award program, insurance program, etc., these could also be discussed at these meetings.

A typical meeting report reads as follows:

Well Name and Number, Rig No., Field.

County, State, Driller.

Days worked since lost-time accident. Number present.

Rig Inspection.

Accident Discussion and Preventive Measures Adopted.

Unsafe Practices Observed.

Any New Employes in Crew. What instruction given new crew members on working safely.

Signed Chairman.

Toolpushers Reaction. Drilling Superintendents Reaction.

**Rig Inspections.** Well planned inspection procedures thoroughly and systematically applied are effective means of discovering hazardous conditions. All contractors know that a considerable amount of time must be expended after each accident merely to restore satisfactory operation. A moderate amount of paid for time is consumed in conducting an inspection, but whatever it may cost in time and money to discover the hazards—in advance of accidents—costs much less than discovering each hazard by the accident it will inevitably bring if left uncorrected.

On-the-spot correction is the most desirable, but in many cases it is not possible. By placing an item that needs to be corrected on the report it comes to the attention of the toolpusher for his action or possible subsequent recommendations to the superintendent, if the action requires considerable expenditure. This, coupled with the regular rig inspection, is an excellent medium that serves as a double check on possible hazardous conditions around a rig.

**Accident Discussion.** The driller, or crew member designated by him may discuss any subject relating to accidents or near accidents. The discussion should be based on his own ideas as to the best procedure for eliminating the hazard being talked about. All crew members should feel free to express their own ideas on the subject. By using this method of a different chairman for each meeting the men are encouraged to think safely. The normal human being looks for the opportunity to show that he has ability. When each man is given an opportunity to express himself, it increases his sense of belonging. Any man wants to feel that he is accepted. The people you work with must not be strangers. This can be overcome at these meetings through exchanging thoughts and feelings.

Many accidents are due to poor housekeeping and this should be a frequent subject at these meetings.

**Unsafe Practices.** Many accidents are due to unsafe acts. Discussions should frequently be devoted to unsafe acts observed by any of the crew members. Naturally, this should be done in a constructive, and not in a critical manner. Attitudes can be changed by exchanging experiences.

In some divisions (Gulf Coast and Canada), the company has expanded safety meetings to include an API, or St. John's Ambulance First Aid Course. It has been found that First Aid training is valuable as it tends to increase the safety consciousness of the individual as well as insure better care immediately following an accident.

While talking about subject matter for meetings, one skeptic stated that all they talked about at these meetings was good housekeeping and hand tools. But a three-month survey conducted in one district showed that 670 different subjects had been discussed —quite an amazing total. In other words, there's no shortage of material to be discussed.

**Any New Employes in Crew.** Instructing new crew members, also serves as a review for the other employes, in the proper use of such equipment as hand tools, tongs, slips, cat heads, spinning lines, and the proper handling of pipe, etc. These subjects supply an almost endless amount of good material for these meetings. It is important to start new employes off on the right foot. Morale is usually high when a man reports on a new job. Keeping this morale high depends on how the new man is treated the first few days on the job. Many a good employe is gained or lost these first few days. A rig meeting to get the new man acquainted with his fellow crew members and the rig is worth the time it takes to conduct one.

**Recommendations.** This space on the report is for any ideas or suggestions that the crew may have concerning safe practices, rig improvement, etc.

The preceding was a discussion of the crews and their self-conducted meetings, but it is very important that communication of ideas and information be up, down and across.

These rig meetings are primarily designed to be conducted *for* and *by* the crews. But, you may remember that we recommended that the toolpusher conduct a meeting once a month with each crew. The superintendent, assistant superintendent, and safety engineer should definitely be seen and heard at these meetings.

Such meetings conducted by supervisory personnel could be called morale, or motivation meetings.

It is important that the toolpusher know the people with whom he is working. They must not be strangers. The toolpusher should know the names and background of his men. These meetings are a means through which he can partly acquire this knowledge. In turn, he can learn of dissatisfaction before it goes too far. If the employes feel free to discuss their grievances then the solution may be more apparent. Employes want more from management than just a pay check. They want to be informed about things in which they are interested. The men want to know about the company, its plans, and what's happening to other individuals in the company.

Up to a point, the employes should be consulted. They want to get into the act. Requesting and using recommendations helps to instill initiative in the individual. It also fills the individual's need for social approval by recognizing the value of his contributions and achievements.

The toolpusher, by dealing with the employes in groups learns of their groups aspirations, attitudes and values. A *team spirit* may then be created which is so important.

Developing this feeling of *each crew a team,* and a pride in their company and their work should be the aim of each supervisor. Rig meetings are an excellent medium to attain these desirable attitudes.

Rig meetings are a means of keeping safety before all the men. A careful and efficient crew that has its mind on the job it's doing, is the best safety device that can possibly be placed on a drilling rig. Rig meetings are avenues through which this ultimate aim can be achieved.

**ACKNOWLEDGMENT**

**This paper was originally presented at the Rocky Mountain Regional Safety Clinic, May, 1956, sponsored by the Casper Regional Chapter of the American Association of Oilwell Drilling Contractors.**

KEY TO SYMBOLS
MINES
PLANTS
OFFICES
MUD ENGINEERING AND LOGGING SERVICE
CENTRAL WAREHOUSES
LABORATORIES
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# Weather . . . Waves . . . and Offshore Oil

**Something can be done about the weather and in offshore operations it pays to know what and when. An adequate weather reporting system could save the industry a fortune annually in time and material.**

By JOHN C. FREEMAN
Gulf Consultants, Houston

OF ALL THE FACTORS involved in offshore operations the one with the greatest effect is weather. Drilling and producing offshore wells would offer little more difficulty than land operation if the water were like glass 365 days a year. Unfortunately it is not, and acute problems result. The solution to these problems need not be left to chance—something **can** be done about the weather. Construction, drilling, supplying and daily operation can be geared to suit the weather if accurate forecasts of its type and severity are made available.

**Hurricanes.** The hurricane and its accompanying mountainous waves form the most obvious weather problem to the offshore oil operator. There are few men who wish to ride out a hurricane on offshore rigs. The waves get 50 feet high; there are 125-mph gusts of wind and the sea level rises 5 to 15 feet.

Since drag forces increase with the square of the velocity of the wind, a wind of 70 mph puts almost twice as much force on a rig as a wind of 50 mph. If a structure is stressed (with safety factors) to withstand a 50-mph wind, it may fail in a 100-mph wind. Of course the expense of building a structure to resist hurricanes may very well be prohibitive. Studies, however, on the effect of hurricanes on structures and pipe lines will save money. Costly damage can be reduced by proper design or inexpensive and expendable structures can be considered. If expendable units are used they should be located to prevent their being swept into permanent structures by wind and waves. The possibility of modern "skyscraper" as a storage and working area on the coast should not be ignored. As costs go up and capital investment increases the cost of protective measures may make completely secure structure such as a skyscraper economically feasible.

The winds in a hurricane spiral into the center getting stronger and stronger as they go in. The strongest winds are to the right and slightly behind the path of the storm. Figure 1 shows the pattern of these winds. This wind pattern moves forward with the center at 10 or 15 mph.

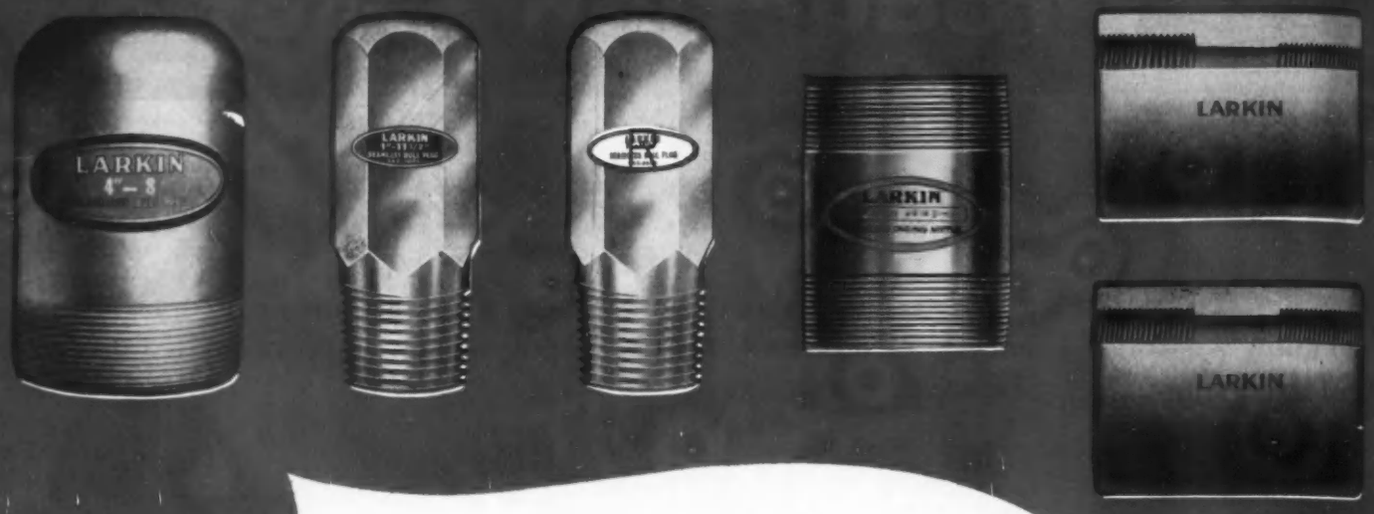
The high waves in the storm cover a much larger area than the strong winds. The very highest occur slightly ahead of the region of the strongest winds. Tides in the hurricane depend on the depth of water as well as the wind speed and wind direction. Coast lines with long shallow shelf areas have higher storm tides than areas with steep coast lines. The accompanying chart of typical storm tides (Figure 2) near the Delta point this out. There is a 6-foot tide at Grand Isle and a 1-foot tide at Burwood.

Nearly every offshore installation has its parent coastal installation. These coastal bases are particularly vulnerable to damage by storm tides and the accompanying waves. If a hurricane drives the water up and into the headquarters area warehouses and structures may be swept away by the combination of currents and waves. Most of the really heavy damage due to hurricanes is caused by this storm tide.

The history of extreme weather and waves is important in design of structures and in planning operations. An important concept is the design hurricane or the design wave. The designer decides the actuarial life expectancy he requires of his structure. Would he want to build so that his structure could be destroyed by a storm or wave once in 25 years? Once in 50 years? Once in 100 years? The really large wave forces and damage due to a wave occur when the wave washes over the platform of a structure. The vertical velocities act on the broad surface of the platform and give a lifting action. The flat horizontal surfaces of a structure are usually concentrated near the platform and large overturning moments result when they are hit. The cheapest and safest protection against wave damage is to build the platform higher than the highest expected wave.

Figure 3 shows that for a location

**The physical operation and economic outlay associated with offshore oil and gas production is phenomenal. Operators and contractors are forced to take calculated risks with hundreds of millions of dollars worth of equipment and thousands of lives every day. With stakes like this they can ill-afford to leave to chance anything that can be approached with certainty.**

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in 80 feet of water near the middle of the Texas Coast the platform will be washed over about once in ten years if it is 22 feet high. If it is 43 feet high it will be awash about once every 100 years and this would require a "good" hurricane. The expected life is increased ten times by doubling the height above mean low water.

The forces due to the wind and the waves are not all that needs to be considered in connection with the design hurricane. The bottom conditions are needed to make an intelligent analysis of the problem. Does the bottom sediment have enough shear strength to hold the structure against the forces that will be met in the storm? Some of the sediments have so little shear strength that the structure is effectively much higher than the part above the mud line indicates. Thus the "overturning moment" meets very little resistance from the piles (see Figure 4). To counteract this action some designers sink large flat plates into the mud to act as anchors. These plates also help support the platform by adding resistance to vertical forces. (They serve in the place of more pilings.

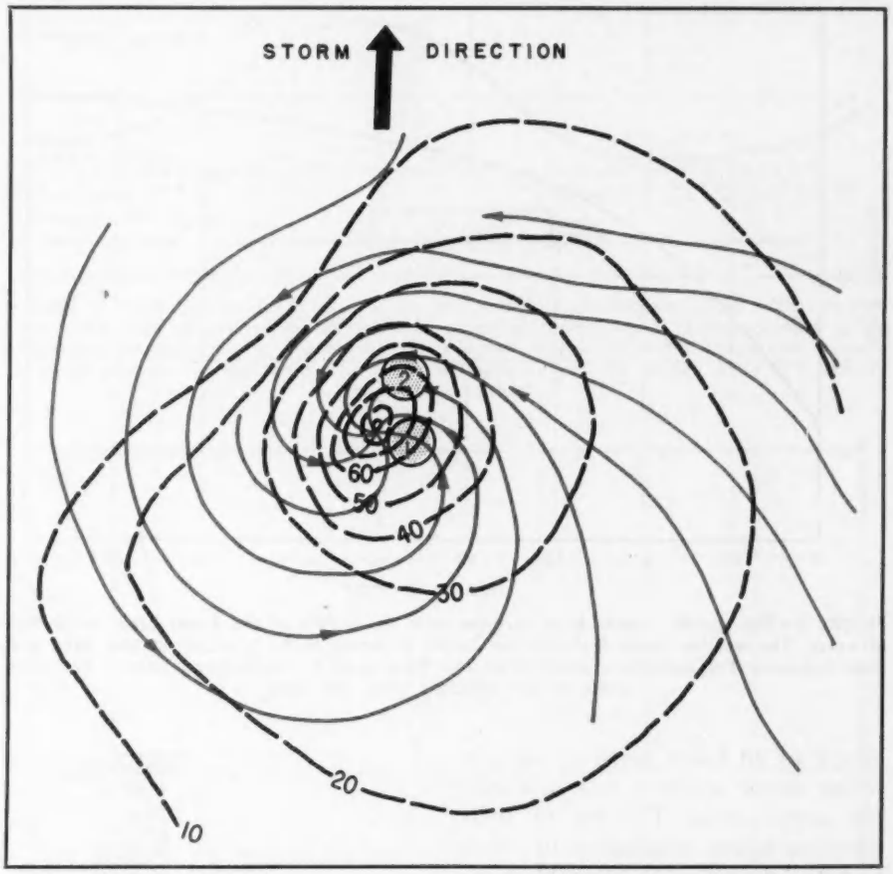


**FIGURE 1—Hurricane winds spiral inward to a center increasing in intensity as they go. The strongest winds are to the right of the storm path and slightly behind the center as indicated by Area 1. Area 2 indicates the region where the highest waves are found as the storm progresses.**

If the mud or bottom sediment is so weak and poorly organized that a really large wave can cause it to act as a liquid or can scour very deeply into it then this sunken plate can become a liability rather than an asset to the structure. A poorly organized sediment, light in weight and interspersed with water acts like a liquid even when stationary.

A 50-foot hurricane wave is not just a surface phenomenon. If the bottom sediments are such that they act like a liquid, a wave is created in these sediments that travels with the surface water wave. The current due to this wave is at least a tenth of that produced by the wave on the surface. This sediment wave scours out the bottom sediments and moves them along. It creates forces on a submerged plate or exposes it and makes it subject to scouring action as illustrated in Figure 5.

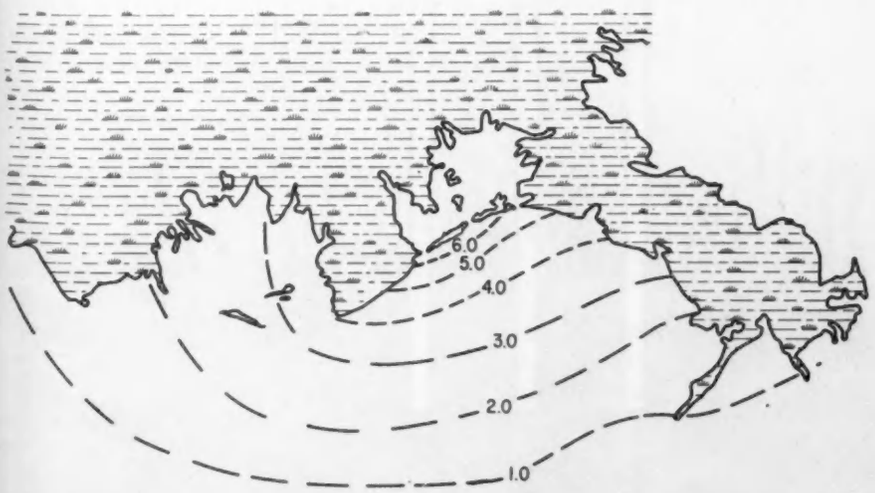


**FIGURE 2—This chart of typical storm tides in the Mississippi Delta area shows a six-foot tide at Grand Isle and a one-foot tide at Burwood. This demonstrates effect of water depth on tides in a hurricane. Coast lines with long, shallow shelf areas have higher storm tides than areas with steep coast lines.**

Detailed knowledge of the composition of the sediments in the vicinity of an offshore oil field is important also in considering gathering lines. Gathering line designers expect their pipe spans to be supported by the sediment. Some sediments are so weak that they will not support the pipe at the depth expected and damaging strains result. On the other hand if the bottom is too hard, perhaps the pipe cannot be buried and will be subject to the action of marine organisms and increased chemical corrosion.

**Day-to-Day Operations.** Weather plays an important part in daily operations. The efficiency with which these operations are handled can be just as important economically as the reduction of hurricane damage.

Most activities offshore require considerable planning and preparation. Many are very sensitive to the height and direction of the waves. Others are affected by strong winds and rain. The weather forecaster can

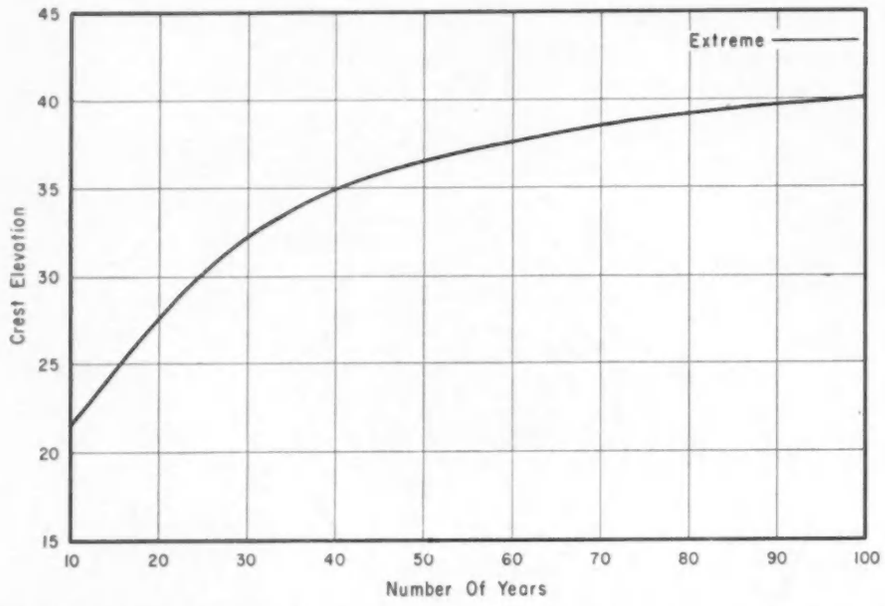


**FIGURE 3—This graph is made for a location near the middle of the Texas coast in 80 feet of water. The weather study indicates the height of waves to be expected in that area and their frequency. For example, a platform 22 feet high would be washed over once in ten years and a 43-foot structure every 100 years.**

give 2 to 18 hours warning of high waves, strong winds or rain in a simple, useful form. The use of such forecasts allows scheduling of work to take advantage of favorable conditions which will usually save time and money.

The planning of a year or two years offshore work should include a study of the wind, waves and temperature to be expected during that period. Some area may have 6 to 8-foot waves for 30 days during the spring. In that case it would be much better to plan wave sensitive work for some other season of the year.

Suppose all work on a certain job was going to be performed in daylight hours. At the present time there are no studies for all depths of the number of hours the waves are above, say, 6 feet during daylight hours. It is known that at the 100 foot depth there are over 1000 hours of waves over 6 feet. Where and when these waves will occur should not be left to a guess. Figure 6 is an example of such an analysis. It shows the number of hours a year waves over certain heights are to be expected in 100 feet of water off the Texas coast.

Suppose Figure 6 were the data for a proposed rig with a tender and the following conditions held (1) supplies could be loaded when the waves were not above 6 feet, (2) the tender could stay along side when the waves were not above 10 feet, (3) tours could be changed and new crews brought in when the waves were not above 5 feet.

It is obvious from this study that up to 335 hours per year could be saved by changing the tours with a better boat or a better system that would allow operation in waves up to six feet. If the cost of such equipment is less than the overtime or lost time involved in interrupted changes of tours then it is economical to use more expensive boats or a personnel transfer system such as helicopters.

The operation of mobile rigs poses special weather problems. A mobile rig must be a compromise between stability while drilling and ease of movement when drilling is finished.

The moving and placing of a mobile unit must be carefully planned. Yet each day of delay costs thousands of dollars worth of drilling time. A compromise must be made

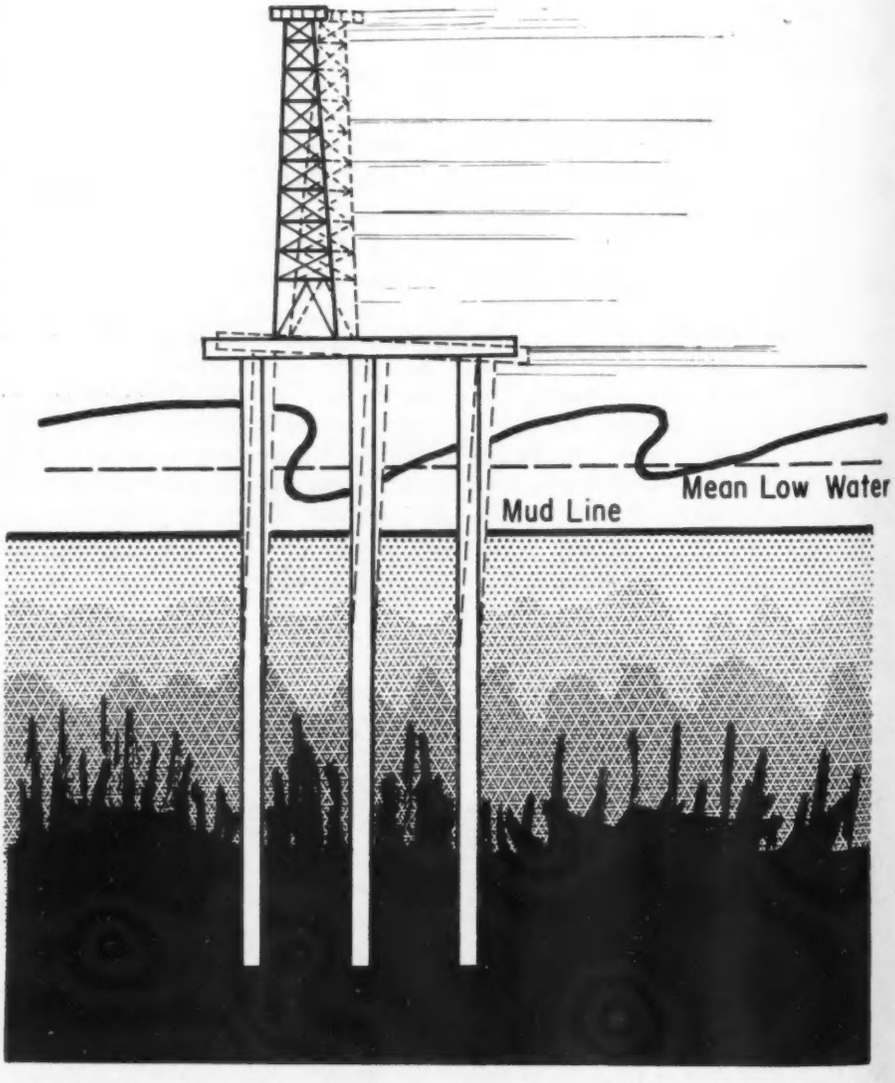


**FIGURE 4—The sheer strength of the bottom sediment has a great deal to do with the stability of the structures which it supports. This is true of drilling barges as well as production platforms. Extremely fluid sediments offer little resistance to any lateral moment exerted by the structure.**

between losing many days through possible damage to the rig and losing a few days while waiting for good moving weather. The more accurate the weather forecasts and the more confidence the operator has in the weather information the more time that can be saved.

If the rig can move safely in ten-foot waves but not in 12 an accurate forecast of nine-foot waves would not delay the move. A forecast of nine-foot waves with an expected accuracy of two feet would necessarily stop the move. If the rig is designed for stability while afloat in ten-foot waves and it makes a three-day move with no weather forecast there is one chance in 30 that the design criterion will be exceeded. There is one chance in 60 that 14-foot waves will be encountered. If this move occurs in the hurricane season with no weather information there is one chance in 900 that the rig will be moving in the middle of a tropical storm with waves higher than 20 feet and winds of more than 60 mph.

In other words if offshore operators were using 100 mobile drilling units and each one moved five times per year then one would be caught moving in a hurricane every other year. At present rig costs can any mobile unit contractor afford to work without good weather service?

**What Can Be Done.** To reduce the element of chance in dealing with weather, management should take advantage of the data made available by precision weather forecasts. This would not only provide additional safety for personnel but probably reduce the need for some of the expensive precautions presently expended and possibly reduce equipment loss and damage.

The professional weather forecaster, with radar network data covering the hurricane, can make very accurate storm tide and wind forecasts for the offshore operator. Radar allows a trained observer to measure the wind speed while the storm is still about 100 miles out to sea. Most of the water level rise occurs as a result of winds within 30 to 50 miles of the beach so that several hours warning of winds and water levels is possible.

The economic feasibility of such a radar system offshore has already been demonstrated by a large chemical company. It also has a good psychological effect on employes when a hurricane is pending.

Suppose the evacuation of a district office requires four hours. The longer personnel can stay in the area the more they can do to protect the office and equipment from possible damage. Radar information supplying hourly statements will allow them to stay at work as long as possible and still evacuate in plenty of time. A radar network similar to that in Figure 7 might be set up to cover a majority of the operations in the Gulf.

There may be a reluctance on the

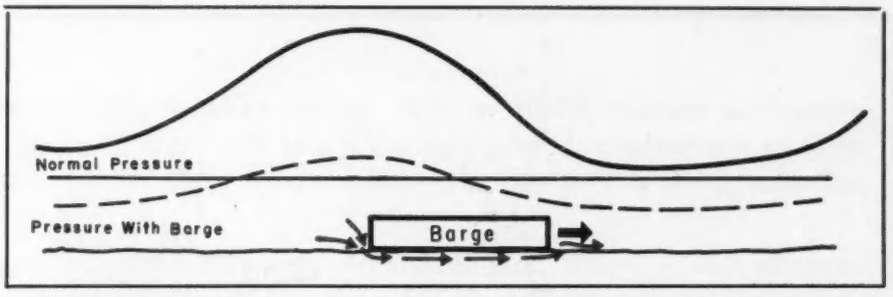


**FIGURE 5—A 50-foot hurricane wave is not just a surface phenomenon. Fluid sediments also form waves with currents about one-tenth as strong as surface waves. Pressures build up on submerged barges producing considerable force against them. Often the barges are exposed to scouring action as illustrated. The result is instability and the sunken plate is a liability rather than an asset.**

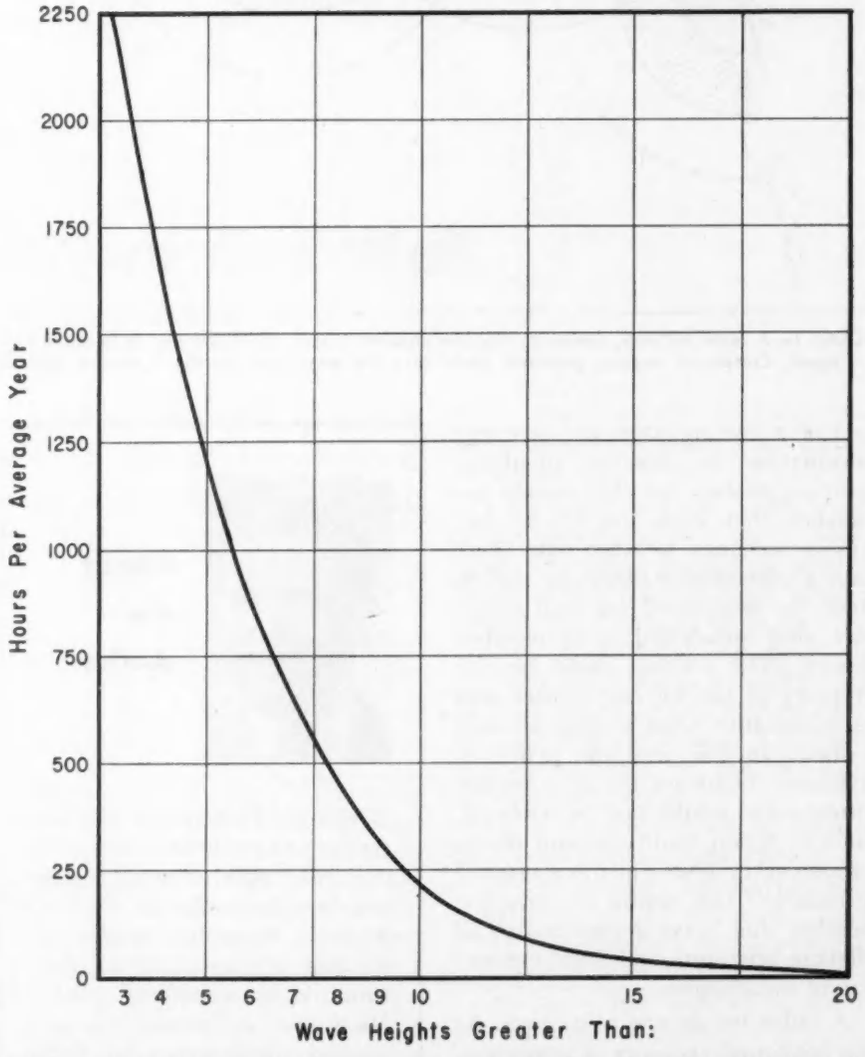


**FIGURE 6—Most offshore activities require considerable planning and preparation. Some jobs are wind sensitive; some are wave sensitive. A chart, like the one above, showing the hours of various wave heights that can be expected, should be made for each sea. With these data, jobs and equipment could be scheduled more effectively.**

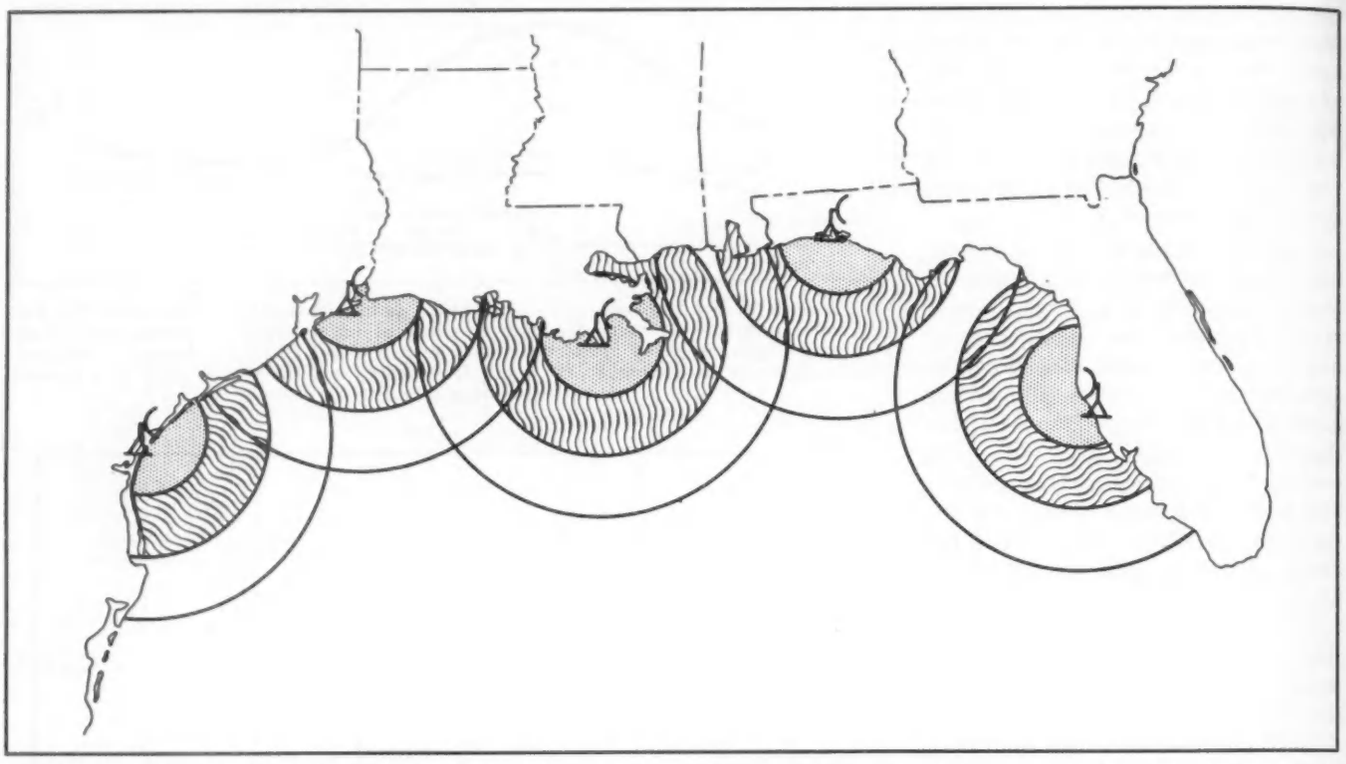

**FIGURE 7—A radar network, similar to the one illustrated here, could provide up-to-the-minute reports on everything from a hurricane to a rain squall. Competent weather personnel could save the petroleum industry a fortune annually in time and material with such a system.**

part of a few operators to share any information for fear of divulging company secrets but they should remember that even the U. S. and Russia exchange weather data. Perhaps a telemetering observing station could be established on each structure that subscribed to a weather service. The station could be the property of the forecast service and its information used to help all subscribers. In this way the policy of company confidence for all company information would not be violated. Such a station could transmit observations every hour (or more often if necessary). This would improve the weather and wave forecasts for all offshore operators and their onshore parent installations.

A radar set detects rain drops. As the individual elements of rainstorms move across the radar set they can be used as a measure of the wind speed offshore (or in any regions where there are no other data). These winds can then be used to forecast waves and water levels. If there is no rain, special targets can be released and followed by the radar set to check the winds. A network of radar sets can serve to warn the operators over the whole Gulf Continental Shelf of approaching rainstorms, winds or waves in their area.

Dr. Malone, a weather expert, emphasized the net saving that would accrue to the offshore operators if radar was used as a day-to-day forecasting tool. The warning of squall lines alone would make the operation of a radar network worthwhile.

Note that the radar *network* has been emphasized in this discussion. A network should have an efficient means of communication of data. In this network it is proposed that facsimile transmission of radar photographs to a central forecast point be used. This forecast central would then advise management and operations branches of the oil companies of the progress of the weather. A similar fascimile network would be very efficient for this purpose.

It all adds up to the fact that weather plays a big part in design and operation dollars offshore and something can be done about it. The initial cost might be a considerable investment but the results that could be achieved over the years would be invaluable. With the intensive development phase of offshore work about to get underway it would be timely to consider doing something about the weather now. —**The End**

## About the Author

JOHN C. FREEMAN has extensive experience in both oceanographic work and weather studies in the Gulf of Mexico. He studied mathematics and physics at Rice Institute and has completed graduate studies in meteorology and applied mathematics at California Institute of Technology, Brown University, and University of Chicago. Dr. Freeman was a weather officer with the U. S. Air Force from 1941 to 1946 and did research in meteorology and oceanography at Texas A. & M. College. Dr. Freeman is now research meteorologist, oceanographer and weather forecaster for Gulf Consultants in Houston.

**It's a tense situation on a platform when gas at 3000 to 10,000 pounds per square inch comes screaming out the end of a flow line. Life jacketed rig hands concentrate on their assigned tasks. This is the final test for their workmanship—the gas well is being unloaded and cleaned for the first time.**

**There is no room for error here. There is no second chance. That is why offshore operators take such precautions. One of these, The Pure Oil Company, outlines the safety procedure it developed as a result of years of experience in bringing gas wells to life.**

# Cleaning an Offshore Gas Well

**You can't be too careful when working with a medium or high-pressure gas well—especially offshore. The Pure Oil Company's method of handling may give you some good ideas.**

**By E. E. REARDON**
The Pure Oil Company
Houston

PROBABLY ONE OF the most critical and dangerous times in the life of a gas well is when the well is being unloaded and initially cleaned. In offshore operations this is particularly true since failure of surface equipment could result in loss of human lives; the loss of the drilling structures which may be valued from $350,000 to $500,000, the loss of the well or wells, which may be valued on a depth basis of $35 to $60 per foot.

With such big losses to be considered, the offshore operator must plan his completion and clean-up program carefully. This usually results in a much more elaborate surface equipment hook-up than normally used on land.

Following is The Pure Oil Company's approach to cleaning and unloading a medium pressure (3000 to 5000 pounds-per-square-inch surface pressure) gas well. For a well of this class all surface equipment and end connections used are rated at or in excess of the API Series 1500 pound rating (5000 pound working pressure and 10,000 pound test). All the end connections used which are not welded or flanged are ½-inch pipe threads.

The christmas tree usually has two master valves; a cross with one wing valve and choke body on one side and wing valve flanged so that a high pressure pump may be tied in on the other side. A swab valve and a swab cap tapped for ½-inch pipe thread is located on top of the cross. The lower master valve is equipped with a pneumatic valve operator and also a manual remote control.

The pneumatic valve operator is actuated by nitrogen. The nitrogen source is a manifold of nitrogen bottles (pressurized to 2200 psi) strategically located on the platform. The valve operator is remotely actuated at this manifold.

The upper master valve is one which is operated by a spring-loaded pilot. Here again an outside pressure source is required and again nitrogen is used. But instead of using the nitrogen energy to close the valve, the nitrogen energy holds the valve open. In the event of a rupture of the nitrogen line or if the pressure is manually bled off the nitrogen line, the valve will automatically close.

All of the wing valves on the tree have remote manual extentions.

The choke body on the tree contains a ¾- or ⅝-inch choke. This choke is primarily a safety choke in the event the control of the well is momentarily lost due to a failure downstream of the choke.

A 3.5-inch O.D. XXSS flow line made up of joints about 20 feet long carries the well stream to a choke manifold located on the edge of the platform. It is secured to the platform by steel brackets that are bolted to the flow line and welded to the structure. The use of such a large flow line might be questioned, but the reasoning justifying its use is very sound. To remove all of the mud and water from the well bore, a gas well must flow at a very high rate.

The required flow rate to remove

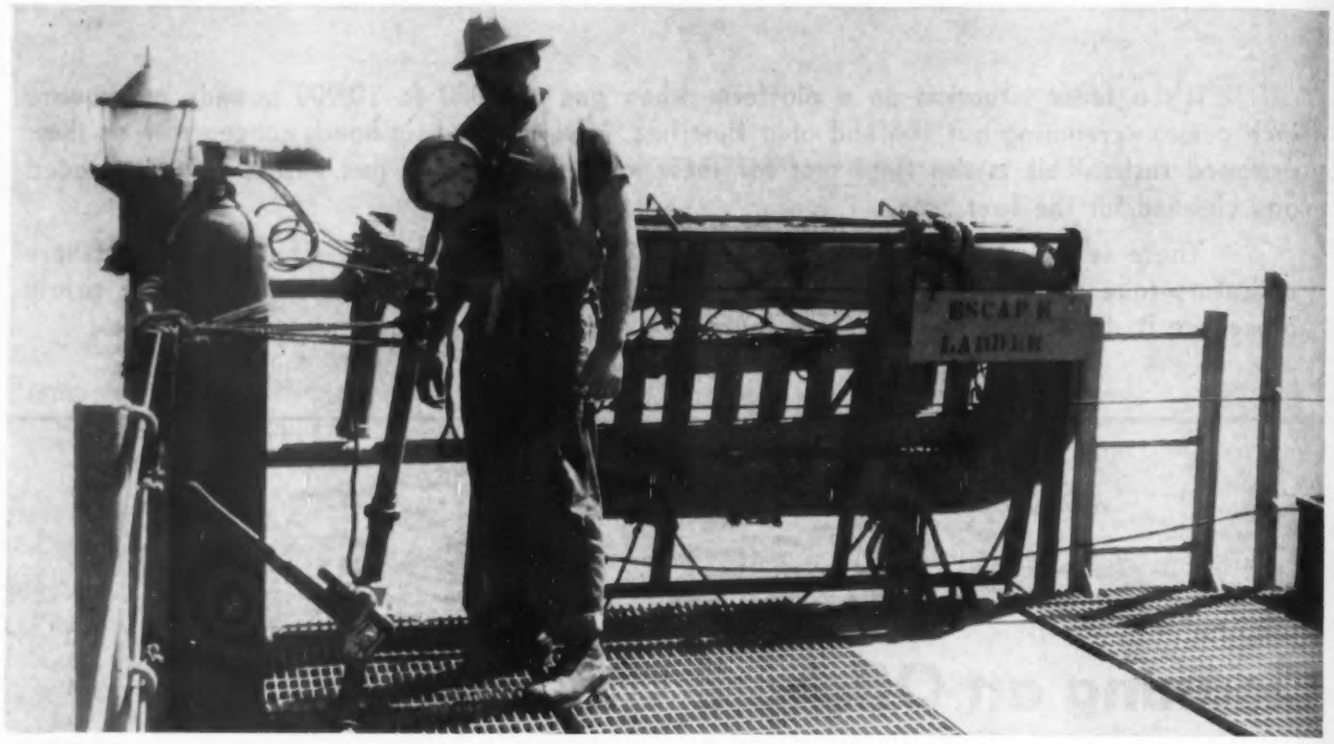


FIGURE 1—Standing at his assigned post, this life-jacketed rig hand waits for the signal that will send him into action. He mans the nitrogen cylinder station from this remote point on the structure while the well is being cleaned. By opening the valve on which the pipe wrench is clamped, he can shut in the well. In addition to conventional safety working apparel and a life jacket, you see the well marked escape ladder and life raft. All are a part of the plan to reduce personal danger while the well is being cleaned.

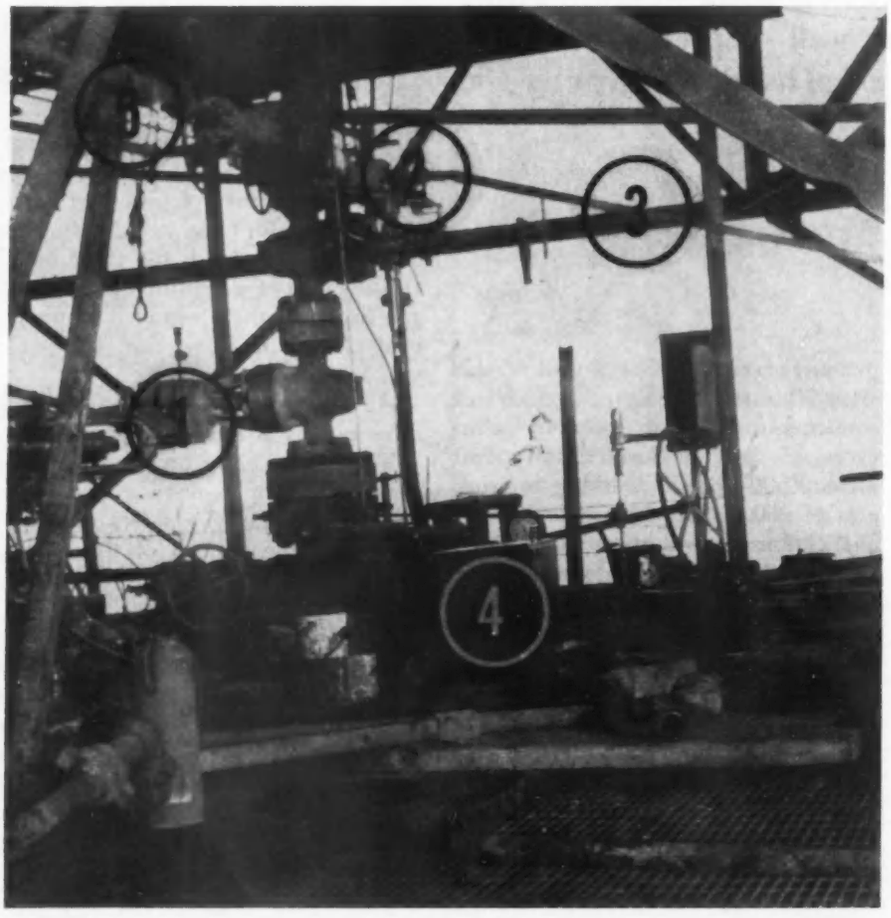


FIGURE 2—This christmas tree has been rigged for a clean-up operation on a medium pressure (3000 to 5000 psi) gas well. Note 1—The pneumatic valve operator on the lower master valve. 2—The spring loaded pilots on the upper master valve. 3—The manual extensions coming from the wing valves. 4—The chemical injection system for injecting methanol into the system to prevent hydrate accumulation. 5—The high-pressure pump tie-in on the wing valve.

the liquids from the well bore increases with the diameter of the tubing used in the completion. In dealing with the two-fold problem of high rate of flow and cutting action of the abrasive materials in the flow stream, it was thought that the best approach to the problem would be to keep the linear velocity of the flow stream as low as possible. This would in turn reduce the cutting action of the abrasive materials in the flow stream. The only way to maintain a low linear velocity is to use a large flow line, and instead of taking an expansion or pressure drop at the choke in the tree, the expansion to atmospheric pressure is made through a choke located at the edge of the platforms. Actually, the full wellhead pressure is carried through the clean-up flow line right up to the edge of the platform before any expansion is taken.

A choke manifold is located on the end of the clean-up flow line at the edge of the structure. Using the choke manifold eliminates any need for shutting in the well to change or clean chokes. As a result the well is cleaned quicker, since the fluid does not get a chance to fall back into the well bore each time a choke change is made. This practice also greatly reduced the number of hydraulic shocks which

normally hit the surface equipment as a result of fluid being allowed to fall back into the well bore.

After testing the surface equipment, the platform is checked to make certain that there are sufficient avenues of escape (such as ladders and ropes from the structure to the water) and all are clear. The engines and motors on the structure are shut down. All personnel on the structure are given life jackets, which they are required to wear as long as the well is being flowed. Each man is assigned a station (remote manual control, nitrogen cylinder manifold, choke manifold etc.) on the platform and must remain at the station until properly relieved or ordered to do otherwise. Before the well is opened, a boat is tied to the structure and is required to stand by during the complete cleaning operation.

If, after all these precautions, duties and assignments have been carried out, there are sufficient daylight hours left, the well is permitted to unload and clean itself. This operation normally requires six to ten hours depending on the depth of the well, size of tubing in the well and rates at which the well is flowed.

For cleaning gas wells of higher pressures, (5000 to 10,000 psi—surface pressure), this same general technique is used with only a few modifications. On gas wells that fall into this class all surface equipment and end connections used are rated at or in excess of the API Series 2900 pound rating (10,000 pound working pressure and 15,000 pound test). All end connections used are either welded or flanged with the exception of the high pressure steel tubing which is used in place of the ½-inch threaded pipe in the chemical injection system for the medium pressure wells.

The Pure Oil Company has successfully used this procedure for cleaning its offshore gas wells for the past four years. —**The End**

**FIGURE 3—Everyone wears a life jacket and a tin hat when a gas well is being cleaned. Here a watch is being kept as the well unloads through the clean-up line and choke manifold. The manifold allows choke changes without shutting-in the well. Note 1—Steel brackets, welded to the structure and bolted to the flow line offer it support. 2—The accessibility of the ring buoy. 3—The avenue of escape at the manifold operator's back.**

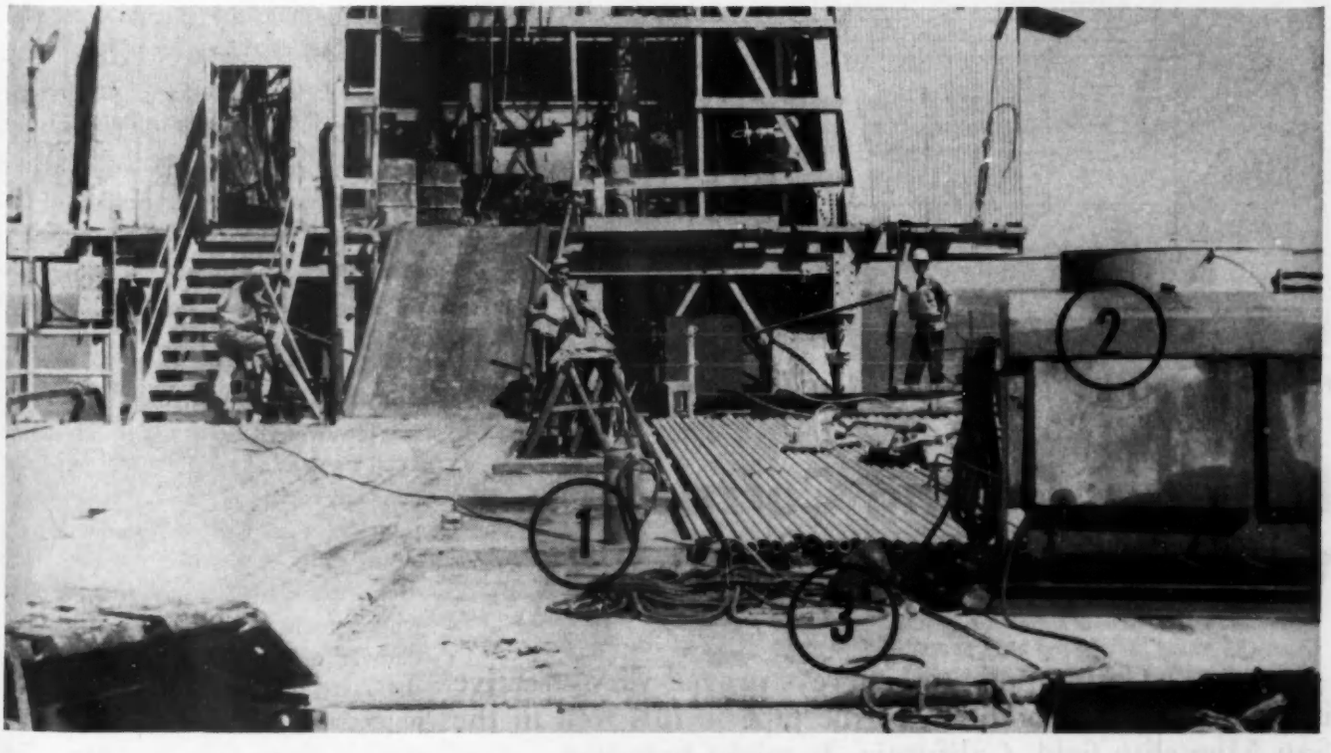


**FIGURE 4—Rig personnel wearing required safety gear are manning the remote manual control stations during the gas well cleaning operation. The clean-up flow line is shown at the left of the platform. 1—Fire extinguisher is readily available. 2—All motors and engines are stopped. 3—Welding operations cease. All these little things and more add up to the safe operating procedure employed by The Pure Oil Company.**

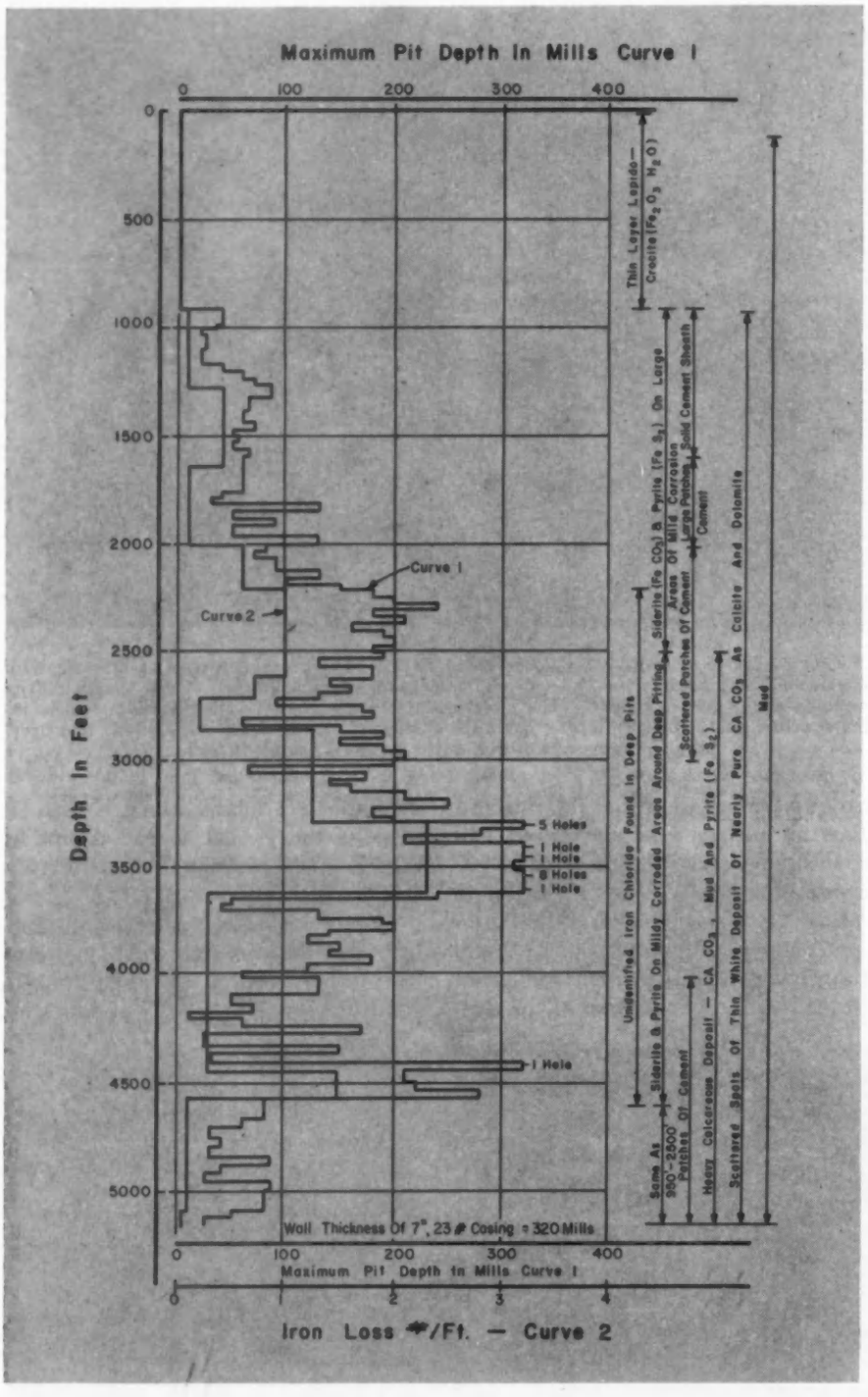


FIGURE 1—Corrosion of Grubb 61 casing. Maximum depth of penetration on each joint is plotted.

# External Casing Corrosion— Where Is It? How Bad Is It?

**Casing potential surveys proved very effective in predicting the condition of the pipe in this well in the San Miguelito field, California. It might help you.**

**By J. D. SUDBURY**
Continental Oil Company
Ponca City, Oklahoma

RESULTS OF a series of casing potential surveys made in several wells in the San Miguelito field, California, showed:

- External casing corrosion is due to an electrochemical mechanism as indicated by the anodic slope of the profiles.
- Three-five amperes of impressed cathodic current was sufficient to remove all the anodic slopes.
- There is a possibility of an accelerated corrosion of the casing at the base of the surface pipe when wells are cathodically protected.

One the wells studied was the Grubb 61 which had been previously shut in due to the presence of several casing leaks. In order to further study the problem it was decided to cathodically protect this well with five amperes of impressed current for six months and then recover the casing. The objectives of this program, in addition to putting the well back on production, were:

- Determine how well the potential profile defined the zone of severe corrosion of the casing.
- Determine the extent of damage at the base of the surface pipe.
- Look for evidence of the effects of cathodic protection on the casing.
- Determine the correlation of the S.P. surveys with the condition of the casing.

The more pertinent facts observed on this job are described in this article.

**Condition of the Casing.** The casing was recovered to a depth of about 5200 feet. Each of the 155 joints was carefully examined in order to determine the extent of corrosion damage. The depths of pits were measured on each collar, the ends of the joints where tools and tongs had caused damage of the metal surface, and in the body of each joint. There is no appreciable difference in corrosion rate in these different areas. The maximum depth of penetration on each joint has been plotted in Figure

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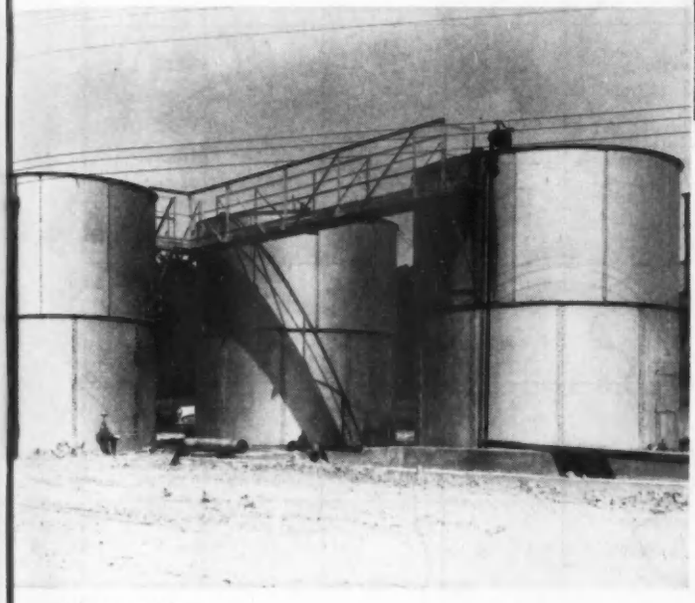
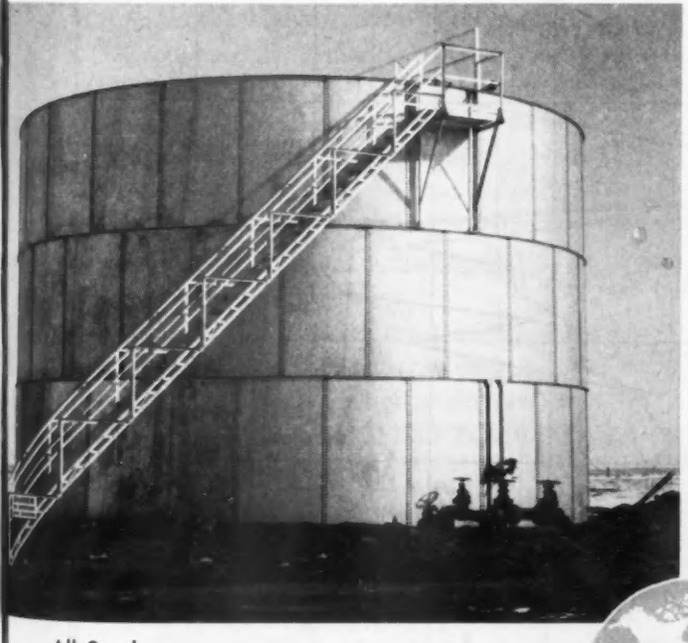


All Rezo-Glas



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TULSA, OKLAHOMA

1. No corrosion was found in the 950 feet of casing inside the surface pipe. There was some corrosion from 1000 to 2200 feet. Then severe corrosion occurred on almost every joint from 2200 feet to about 4600 feet. Below 4600 feet corrosion was again not severe. The different types of corrosion are illustrated by the photographs (Figures 3 through 13).

Figure 3 is typical of the mild attack in zone 1000 feet to 2000 feet. Figures 4, 5, 6, 7 and 8 show the severe corrosion found in the zone 2200-4600 feet. Figure 9 shows isolated hole in section of pipe not otherwise badly corroded. Figure 10 shows the heavy porous calcareous (calcium carbonate) deposit found over large areas of pipe. This was probably deposited when the well was originally completed with a relatively high pH drilling mud.

For possible use in correlation work the actual depths of the 16 holes in the casing are recorded below:

| Depth | No. of Holes |
|---|---|
| 3295 | 3 |
| 3300 | 1 |
| 3302 | 2 |
| 3416 | 1 |
| 3448 | 1 |
| 3539 | 4 |
| 3552 | 1 |
| 3577 | 1 |
| 3604 | 1 |
| 4442 | 1 |
| Total | 16 holes |

**Nature of Scales and Corrosion Product.** The primary solid deposits found at various depths have been tentatively identified as indicated by the right margin in Figure 1. In summary the scales were of the following type.

1. Thin film of iron oxide to the base of the surface pipe.
2. Mud appears on all joints below 100 feet.
3. Cement was found from 950-1600 feet with scattered patches to a depth of 3000 feet. This apparently entered the well from the adjacent well.
4. A mixture of iron carbonate and a small quantity of an iron sulfide was found on areas of mild corrosion from a depth of 950 to 5200 feet. The scale was black, very hard and was magnetic.

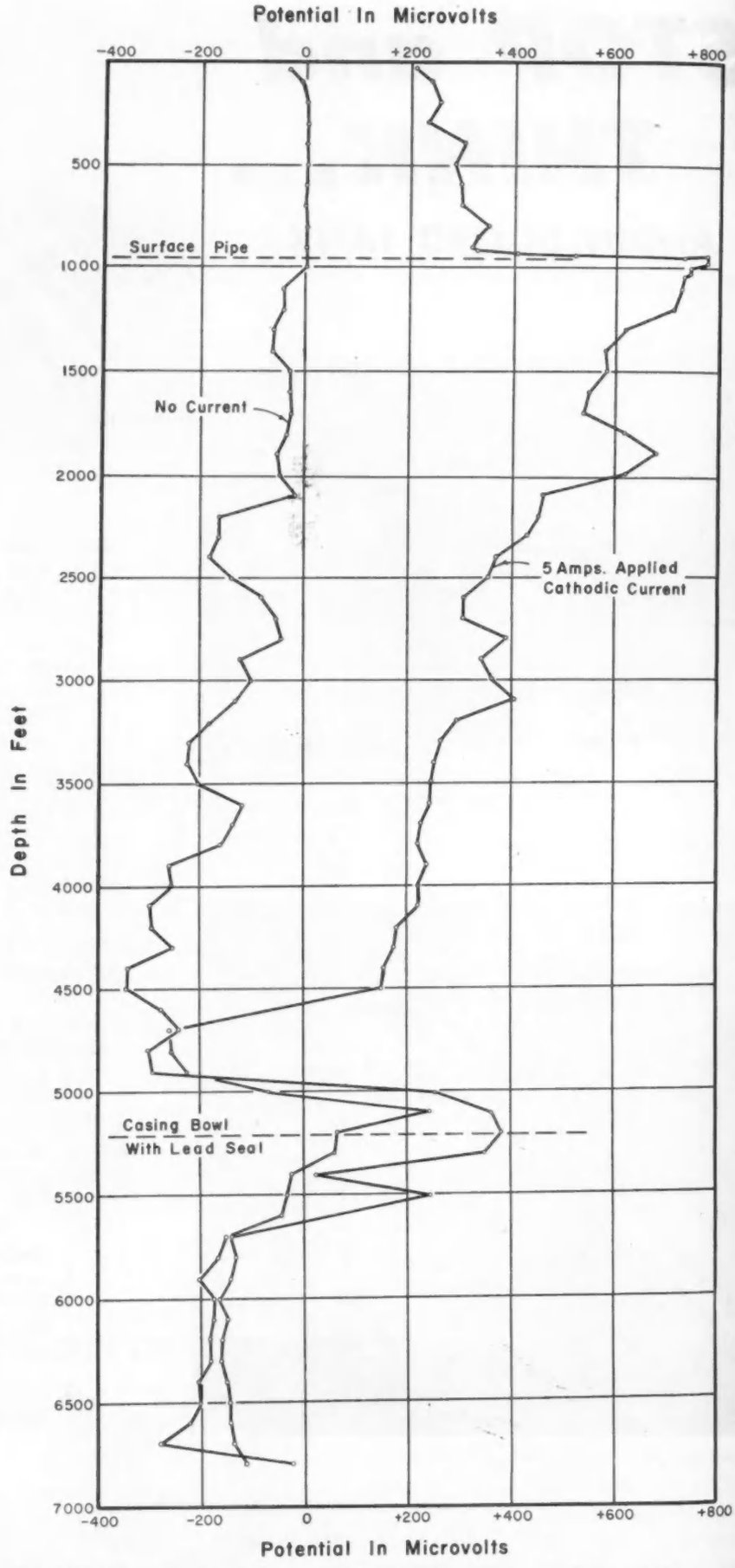


FIGURE 2—Casing potential profiles on the Grubb 61 with new pipe and mud in the hole. The effect is apparent with an interesting condition existing in the vicinity of the lead seal of the casing bowl.

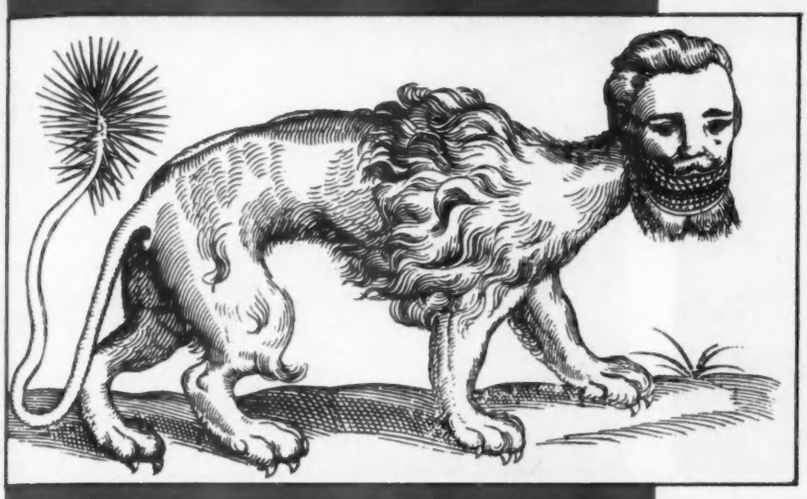

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FIGURE 3—Sixty mil pits at 1580 feet—typical of corrosion from 1000 to 2500 feet. Corroded areas covered by hard black scale which is in turn covered by cement.

FIGURE 4—Three holes in area of severe pitting at 3357 feet.

5. In the areas of severe corrosion (2200-4600 feet) a reddish-brown scale was found in the corrosion pits. This material is an unidentified iron chloride. This material is only slightly magnetic and slightly acid soluble, with no sulfides or carbonates present.
6. A very heavy calcareous deposit was found from 2500 to 5200 feet. This deposit is a mixture of $CaCO_3$ and mud.
7. A very thin white deposit was found in scattered areas from 950 to 5200 feet. It was found to be almost pure $CaCO_3$ present as mixture of calcite and dolomite.
8. Scattered patches of cement were found from 4000 to 5200 feet.

**Correlation of Pipe Condition with Profiles.** According to the original profiles, it was predicted that severe corrosion should begin at 2500 feet and end at 4600 feet. It was found that all the 16 holes were in this interval. It was further found that in all but two minor places, all corrosion penetration greater than 100 mils was in the range 2200-4600 feet. This is very nearly the same area as defined by the profiles. It was shown that all the crevice corrosion at collars occurred in this zone defined as corrosive. All this severe type corrosion was characterized by deep, rounded pits and a reddish-brown iron chloride as corrosion product with no traces of iron carbonate or sulfides.

In addition to the above described corrosion there was the mild corrosion typified by Figure 3. This was found in the interval 1000-2200 feet and the interval 4600-5200 feet not defined as corrosive by the profiles. It was also found to a lesser extent in areas of pipe surrounding the deep pits in very corrosive areas. This corrosion is typified by the very hard, black magnetic scale consisting of crystalline iron carbonate plus some iron sulfide. The origin of this type corrosion is clouded by the presence of large amounts of cement from 1000-2000 feet which is believed to have entered the hole from the Grubb 13.

It must be concluded from the present evidence that the potential profile did show the most severe corrosion problem from 2200-4600 feet but did not pick up the less severe type of corrosion on the rest of the pipe. These results are very encouraging.

FIGURE 5—Severe pit corrosion at 3350 feet—typical of corrosion from 2500 to 4500 feet.

**Condition of Casing at Base of Surface Pipe.** The casing in the vicinity of the shoe of the surface pipe (945 feet) was examined very care-

FIGURE 6—Severe corrosion at 3350 feet. Corrosion is on edge of casing caked with mud.

FIGURE 7—Crevice corrosion at 3600 feet. This is typical of that found on all joints from 2500 to 4500.

fully for evidence of accelerated corrosion due to the cathodic protection. The observations made showed two distinctly different phenomena at this point.

First, there are 40 mil pits over a span of two feet above and below the shoe. These pits are filled with iron sulfide and this covered with an adherent layer of cement. These pits are illustrated in Figures 11 and 12. It was difficult to see how these pits could have occurred under the cement. It is also difficult to explain their presence at this point by any other means.

Second, there are large areas of a mild attack as pictured in Figure 13. There is about a 20 mil loss of metal extending for 20 feet above and below the shoe. There are lesser similar patches over several joints below this. The only corrosion product was a thin wet film of what appears to be some oxide of iron. This 20 mil metal loss over 40 feet corresponds very closely to the metal loss of 20 pounds of metal loss in six months as was predicted by the break in the original potential profile. It is believed that this corrosion is almost certainly due to the cathodic protection applied to this well.

Fortunately this corrosion is spread over 40 feet and failures at this point could not be expected in less than five years of cathodic protection. This will give time to observe other pulling jobs similar to this one.

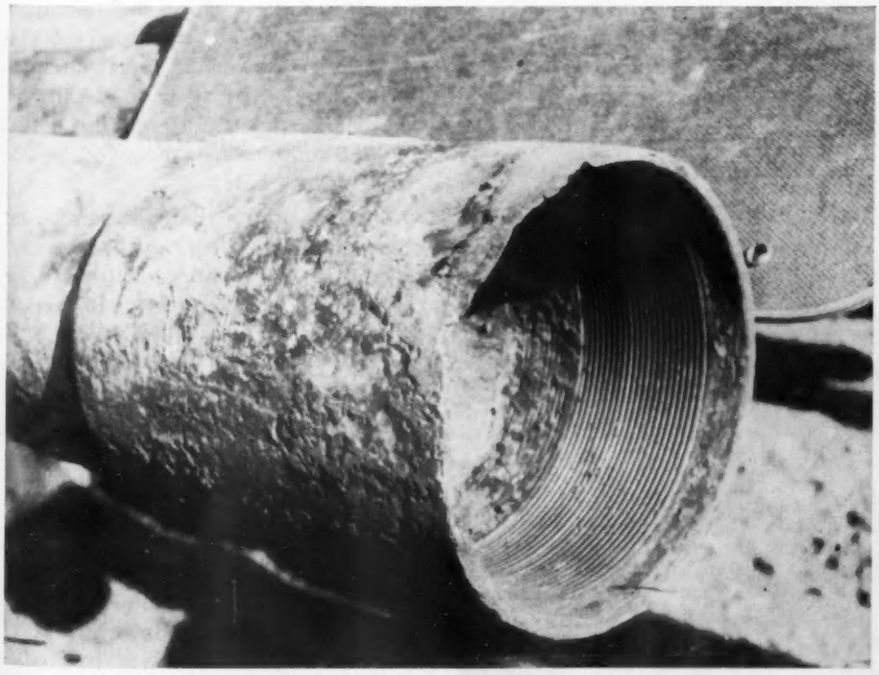

FIGURE 8—Corroded collar at 3310 feet. Pits are 280 mils. This is typical of collar corrosion found from 2500 to 4500.

**Evidence of Effectiveness of Cathodic Protection.** The original surveys indicated that cathodic protection was effective in removing all the anode areas to depths of 6000 feet. The five ampere current left on the Grubb 61 should have been sufficient to stop the gross anodic corrosion in progress on this casing.

On pulling the pipe it was noted that the corrosion product and the pits were dry as if corrosion had not been proceeding recently. Such a conclusion is not made with any great certainty. It may be more a matter of wishful thinking.

Attempts were made to find a high pH film developed by the cathodic protection on the surface of the pipe. These films could not be found due to contamination by the muds used in the washover operation.

A very thin, moist, white film was noted in many areas to the total depth of pipe recovered. This film was shown by the X-ray analysis to be

FIGURE 9—Single hole at 3416 feet. Hole is in an area not otherwise severely corroded. This is not typical but this isolated corrosion was found in a few places.

FIGURE 10—Hard, thick, porous calcareous scale typical of that throughout string of pipe.

almost 100 percent calcium carbonate present as a mixture of calcite and dolomite. It is felt that this thin film could easily have been due to the applied cathodic protection.

**Potential Profiles After New Pipe Run.** After recovery of all the casing to 5152 feet a lead seal casing bowl was run and new pipe set in the hole. A centralizer was set between the surface pipe and casing at 930 feet. Immediately after setting the new pipe, a casing potential profile was run with results as shown in Figure 2. The nice smooth anode areas as found in previous profiles was not found in this hole containing new mud and new pipe. Instead, a very erratic series of breaks in the curve was noted. It is probable that sufficient time had not elapsed for establishment of equilibrium conditions in the hole. It was interesting to note that there was a potential reversal in the vicinity of the lead seal of the casing bowl.

The effect of five amperes of applied cathodic current have also been plotted on Figure 2. These results show the impressed current to have some effect in smoothing out the erratic profile with no currents.

The one very significant point was that there was no effect of cathodic protection below the casing bowl. This means that where such patches are made on systems to be cathodically protected, below the patch, some means must be derived for shorting across the lead.

**Effect of Centralizer Between Surface Pipe and Casing.** The centralizer was installed to offer a metallic path for the current transfer at the base of the surface. There should be no doubt of the adequacy of this centralizer. However, the potential profile *cannot* be used to determine whether current transfer is through a metallic conductor or through an electrolyte in the hole.

The use of the centralizer must be considered singly as an inexpensive technique which will probably reduce the surface pipe problem. It cannot in any way increase the problem.

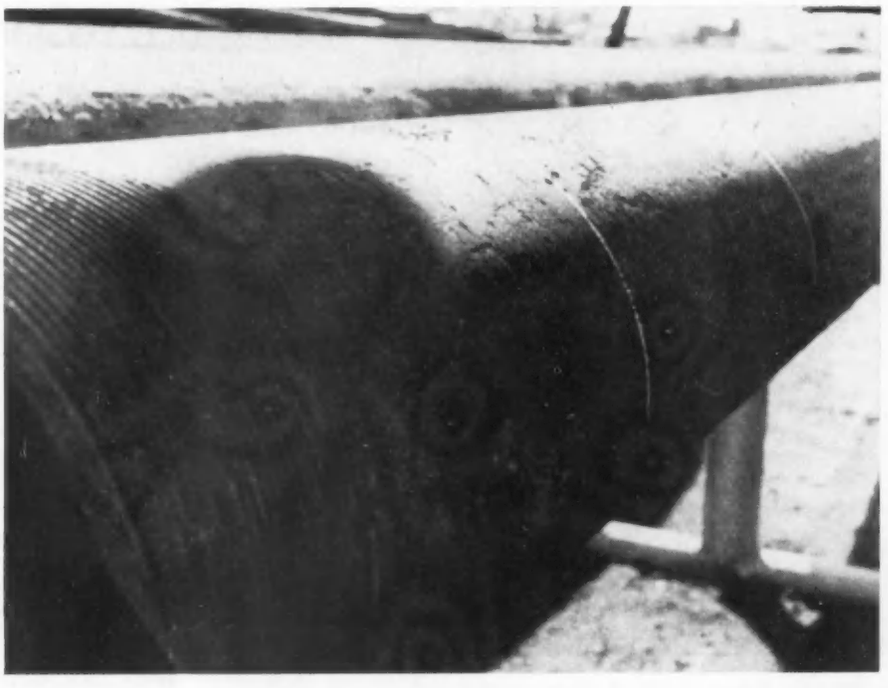

FIGURE 11—Forty mil pits just above shoe.

## DISCUSSION OF FIELD RESULTS

On the basis of the results described above it seems that cathodic protection can be successfully used to prevent external casing corrosion. Of course, all the measurements made were on 25-foot spans of pipe and may not tell the complete picture of the lesser intervals. However, it is believed that this problem is similar to pipe line corrosion problems and that cathodic protection has very good

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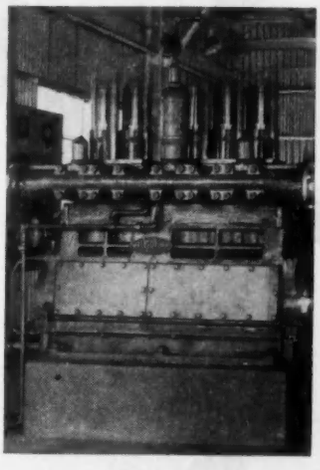

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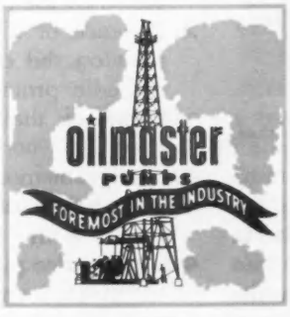


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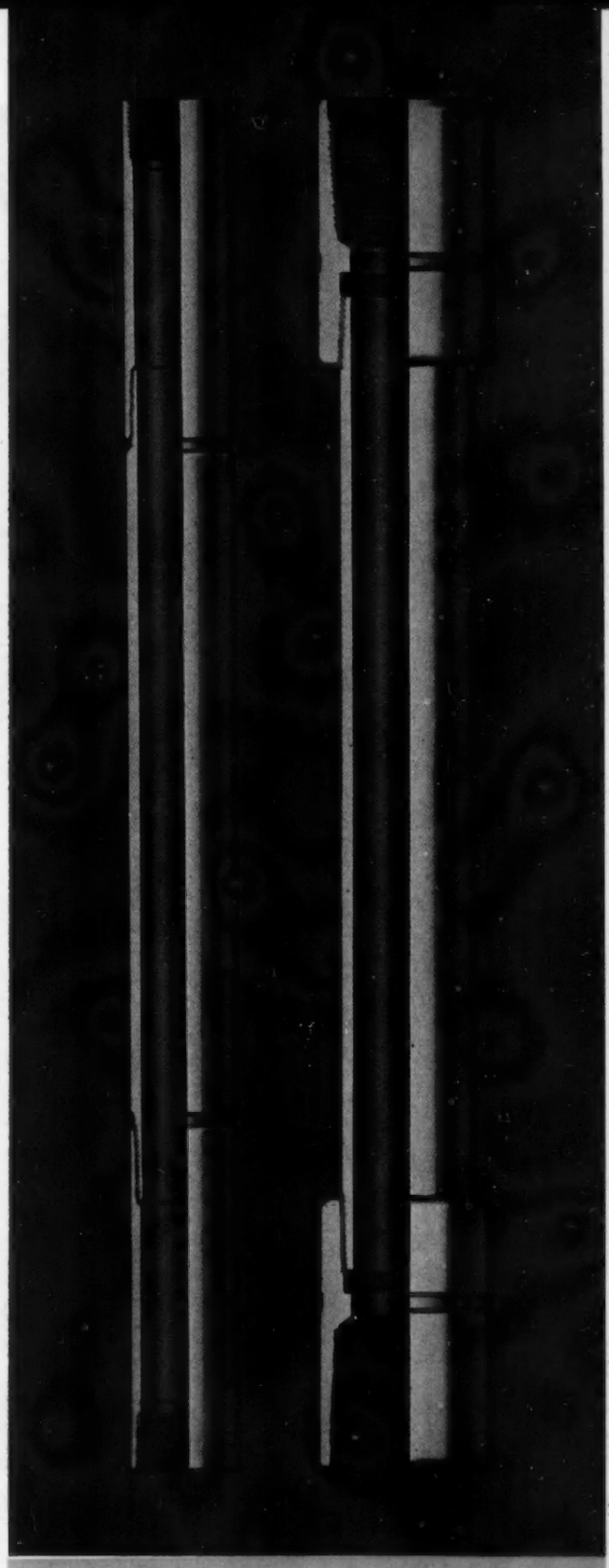

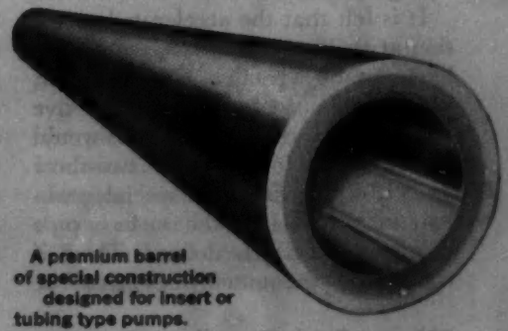

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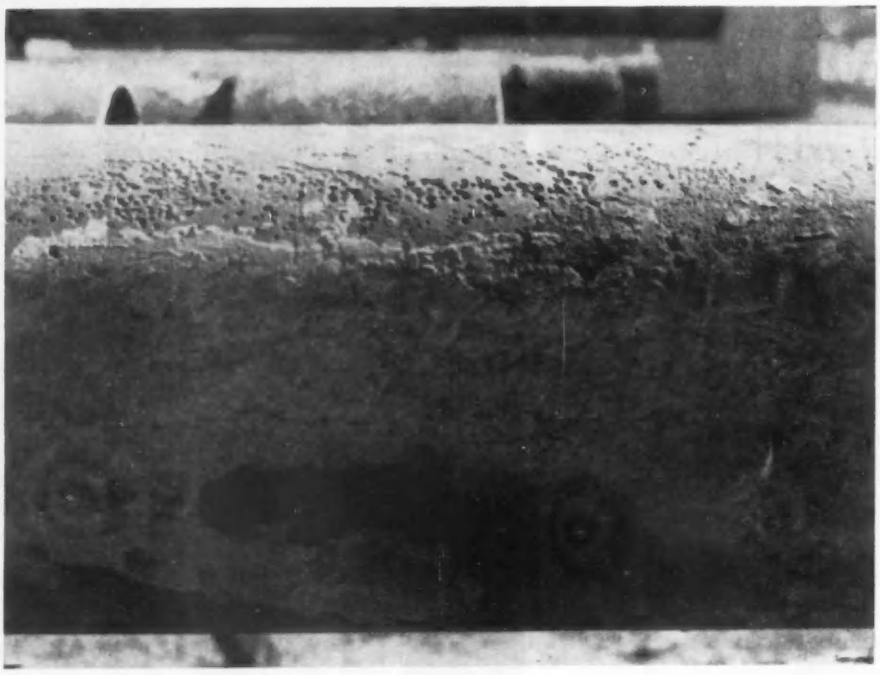


FIGURE 12—Forty mil pits just below shoe. More such pits can be found beneath the pictured cement.

FIGURE 13—Twenty mil loss of metal—typical of that found 20 feet above and below shoe.

probabilities of materially reducing casing corrosion.

It is felt that the accelerated corrosion at the base of the surface pipe is likely to be a real effect. However, since no failures are likely in five years, no preventative measures would be necessary for at least two-three years. In this time the special problem at the base of the surface pipe can be more clearly defined. Then, if necessary, adequate preventative measures can be taken. In this respect, a pup joint of tubing, suitable for introducing an insulated wire into the casing, is being made up in the laboratory.

Even if the surface pipe problem could not be resolved, cathodic protection would probably be advisable in the San Miguelito field. A casing repair at 500-1000 feet is certainly more desirable than a series of holes to depths of 5000 feet.

**Mechanism of Corrosion of Grubb 61.** Some comment should be made about the mechanism of the corrosion as found in the Grubb 61.

It is suggested that the severe pit type corrosion is due to an electrochemical action with the pitted areas being the anode areas. The cathodes of local cells may be the mildly corroded areas surrounding the pits and the gross or major cathode area being the region 1000-2200 feet. This was indicated by the profiles. The sulfate-reducing bacteria shown to be present act as *depolarizing* agents. In other words, they continually remove atomic hydrogen formed at the cathode. This allows corrosion currents to flow at a rapid rate. A by-product of the sulfate-reducing bacteria is the formation of $H_2S$ and $CO_2$. These gases act to give the mild corrosion found in the proposed cathode areas. It is not believed that the sulfate reducers actually attack the steel. Instead, its prime function is as a *cathodic depolarizer*. Neither are $H_2S$ and $CO_2$ considered as prime corrodents. They give a mild attack in the gross cathodic areas.

Simplified versions of the reactions believed to be involved are shown as follows:

**Anode Reaction**

$$Fe^{\circ} \rightarrow Fe_xCl_y + e^-$$

(Results in severe pit corrosion)

**Cathode Reactions**

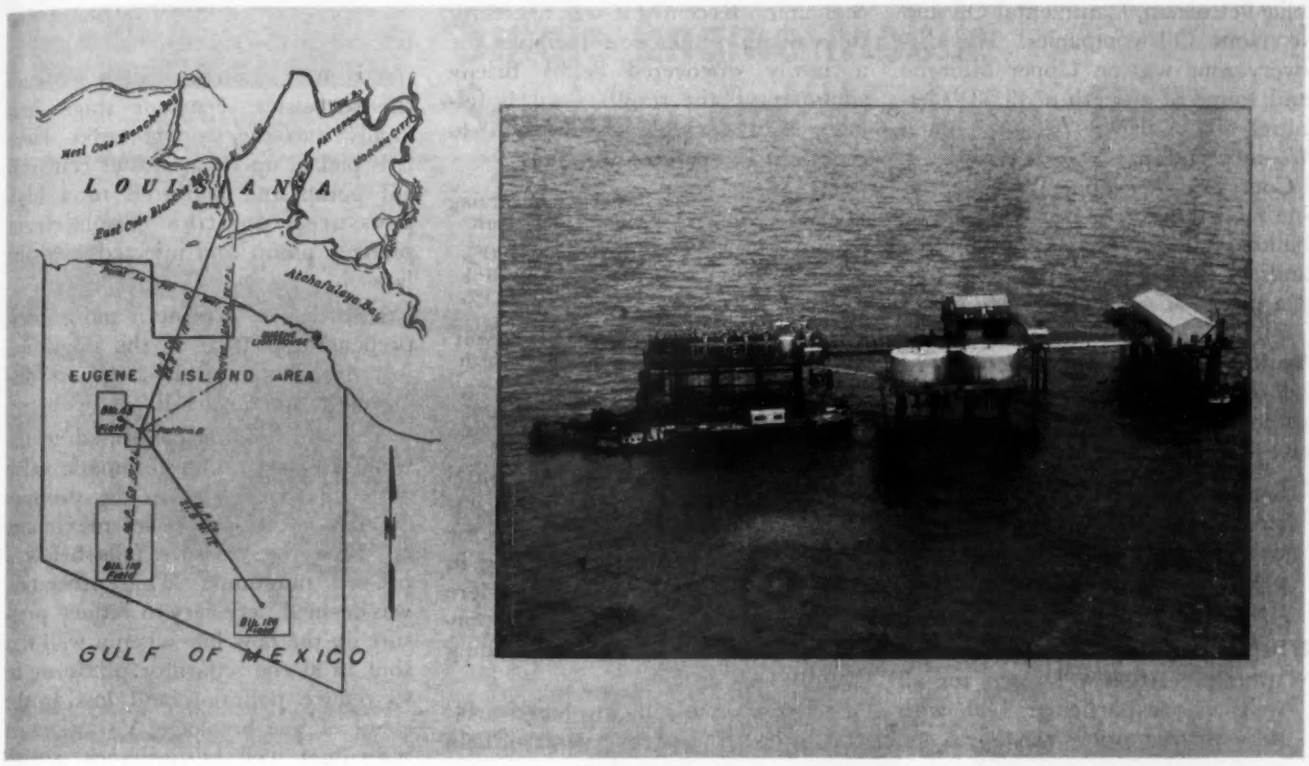
$$H^+ + e^- \rightarrow H^{\circ}$$ (polarization reaction)

$$H^{\circ} + \text{sulfate reducers} \rightarrow H_2S + CO_2$$ (depolarization reaction)

$$H_2S + CO_2 + Fe \rightarrow FeCO_3 + FeS_2$$ (mild corrosion)

## CONCLUSIONS

1. The condition of the Grubb 61 casing was pretty much as predicted by the profile measurements.
2. Presence of a thin calcareous deposit on the casing indicated that cathodic protection was being effective to the depth of casing recovered.
3. The problem of accelerated corrosion at the base of the surface pipe is real in this well.
4. The surface pipe problem is not of sufficient severity to prevent installation of cathodic protection in the San Miguelito field.
5. An applied current of five amperes should be sufficient to prevent the gross anodic corrosion in each well in this field. It is believed that this will reduce the corrosion problem in this field. —**The End**




Offshore production facilities offer a real challenge to management and engineering. Evaluating construction, storage, barging and miscellaneous costs requires considerable technical data. The final product may look something like this production platform in Eugene Island Block 126 field which was built jointly by the Magnolia Petroleum, Continental Oil and Newmont Oil companies.

# A Production Platform Pays Off

**Central production platforms will play an important role in the development program predicted for the next three years in the Gulf. The economics and engineering that go into these long-legged giants make an interesting study. How is the decision reached to build one? What will it contain? Here is one answer to these questions.**

By **A. H. MASSAD,** Morgan City, La.
**E. C. PELA,** Dallas
Magnolia Petroleum Company

THE PRIMARY factor in handling offshore oil production is to provide an economical means by which continuous uninterrupted flow may be established from the wellhead to the crude purchaser. A central production facilities platform has been installed for this purpose in the Eugene Island Block 126 field, La., Gulf of Mexico by Magnolia Petroleum Company, Continental Oil Company, and Newmont Oil Company, and is now operating successfully.

The central facilities platform with a line connection to a shore terminal was evaluated against barging from either individual well platforms or from a central storage point in a field. Although the initial investment of such installations exceeds either of the other two methods, it offers a reduction in operating expense which results in a higher net profit.

In designing an installation such as this, the following requirements had to be achieved:

- Flexibility of operation.
- Provide continuous flow.
- Accurate well testing for allocation of production.
- Provide for expansion in future.
- Maintain control of production on the separator platform.

These requirements have been fulfilled by the installation described.

**Field Description.** The Eugene Island Block 126 field is a piercement-type salt-dome structure. The dome is typical of those found in southern Louisiana, and exhibits the normal complex faulting characteristics. The discovery well was No. A-2, Block 126, and was completed in April, 1950, for the joint account of Mag-

nolia Petroleum, Continental Oil and Newmont Oil companies. The discovery zone was an Upper Miocene sand, found at a depth of 11,531 feet. Initial potential was 788 bopd on a $14/64$-inch choke.

Continued development of the marine sands led to the discovery of the shallow, undifferentiated, non-marine sands in 1954. These sands are found at a depth of 4000 to 7200 feet.

**Production Handling Methods.** In the offshore operations, three basic methods for handling oil production have been exploited:

1. Separation, measurement, and storage facilities at each individual well platform, with subsequent barging to an onshore distribution point.
2. Separation, measurement, and storage centrally located for all wells in one particular field, with subsequent barging as above.
3. Individual flow lines from each well in a field to central facilities for that field, which would contain equipment for separation, measurement, and delivery of oil and gas to an onshore terminal for final separation and sale.

The above methods are not the only ones considered in offshore operations, but are the most prominent in areas where enough production is available to make its handling or transportation a problem. Other methods have been used, such as flowing directly from the wellhead into the transporting barge. This method is adequate in protected waters, but involves too many hazards for use in open areas of the Gulf. Also, the use of submersible-reversible oil storage has been studied.

Considering the three methods above, Condition 1 is usually found in isolated areas, and where single wells have been drilled to validate a lease. This was also the predominant method in the early phases of offshore operation.

Condition 2 is applicable where two to five wells have been completed in the field, or where daily production is above 1000 b/d.

Condition 3 is favored where production is increasing and favorable potential exists in the field.

The selection of a method depends on the situation and the governing economics. Recently it was necessary to evaluate production facilities for a newly discovered field.[1] Briefly summarized, the results were as follows, if we assume Condition 1 to represent 100 percent.

| Method | Initial Cost | Operating Cost |
|---|---|---|
| Condition 1 | 100% | 100% |
| 2 | 158% | 91% |
| 3 | 176% | 23% |

| Method | Net Profit | Present Worth |
|---|---|---|
| Condition 1 | 100% | 100% |
| 2 | 99% | 98% |
| 3 | 122% | 121% |

It is seen that although the initial cost is higher for Condition 3 (central facilities), the operating expense is considerably reduced, resulting in an ultimately greater net profit. Here again the weather factor is important, since oil barging and loading require calm seas.

These comparisons are based arbitrarily on the first five years of field operation. A longer operating life will increase the economic advantage resulting from use of Condition 3.

The method described in Condition 3 was chosen for the Eugene Island Block 126 field. The three main reasons for this decision were:

1. The average loss of 10 to 20 percent of the annual production due to weather is eliminated.
2. Direct operating cost per well, including transportation to shore, was reduced 46 percent as a result of the changeover.
3. Additional development is anticipated in both the deep and shallow sands.

Oil and gas production from Block 126 is routed from the wellhead to the central platform shown in Figure 1, where choke manifolds for each well are installed to permit control of individual wells from the central location. Well production is routed through stage separation units, entering the highest stage separation pressure at which the well is capable of producing its allowable.

Gas production will be routed through a manifold to the compressor mounted on the machinery platform, where it will be picked up and compressed to the inlet pressure of the two-phase line. At the present time, no sales contract has been negotiated, and gas not available at inlet pressure of the two-phase line is flared at Block 126.

Oil production is routed through the successive separator stages and finally into the storage tanks. Here it is picked up by a booster centrifugal pump and delivered to a high pressure, positive displacement plunger pump and injected into the line.

In order to present a more comprehensive picture of the operation just described, certain steps are discussed in greater detail.

The flow line is connected to the wellhead through an automatic valve designed to close when the pressure exceeds a certain pre-set maximum, or when the pressure falls below a pre-set minimum. This protection was deemed necessary to reduce pressure on the flow line when a well was shut in at the separator platform, or to reduce pollution and loss in the event of line breakage. Variations in individual well performance are so great that these valves cannot serve their intended purpose, and their installation has been discontinued. In addition, connections for a free water knockout are available, should this item be needed. Sand traps are installed in the flow lines on well platforms as required.

Oil and gas production from the well platform is transported to the central separator platform through 3-inch flow lines, averaging approximately 4500 feet long. These lines are tied into a dual choke manifold used to permit choke changing without shutting in the well. The need for a dual choke installation is greatly reduced when the high-low pressure shutdown valve is eliminated at the wellhead. In cases where sand production is not a problem, provision for a single choke should suffice.

Stage separation is employed to minimize future offshore gas-compression horsepower requirements. Since oil and gas are commingled in the gathering line to shore, crude stabilization or maximum recovery of liquids by stage separation is not a problem here. When gas sales are arranged, stage separation units are designed to operate at 1500, 750, 375, and 30 psi.

Test separators are provided so that information necessary for production allocation, well control, and

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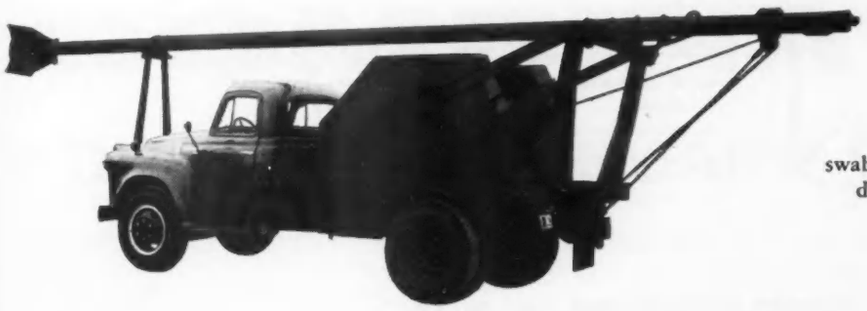

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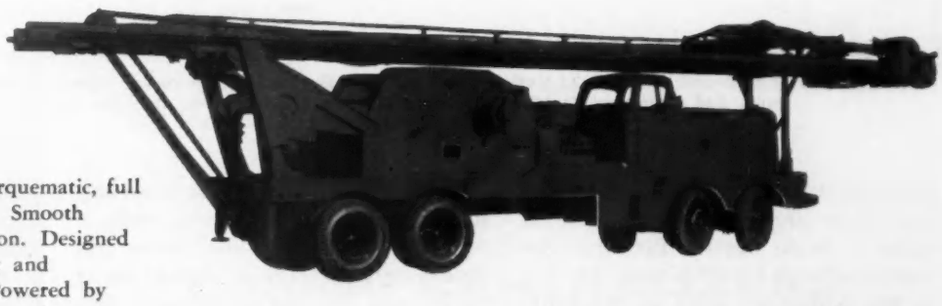

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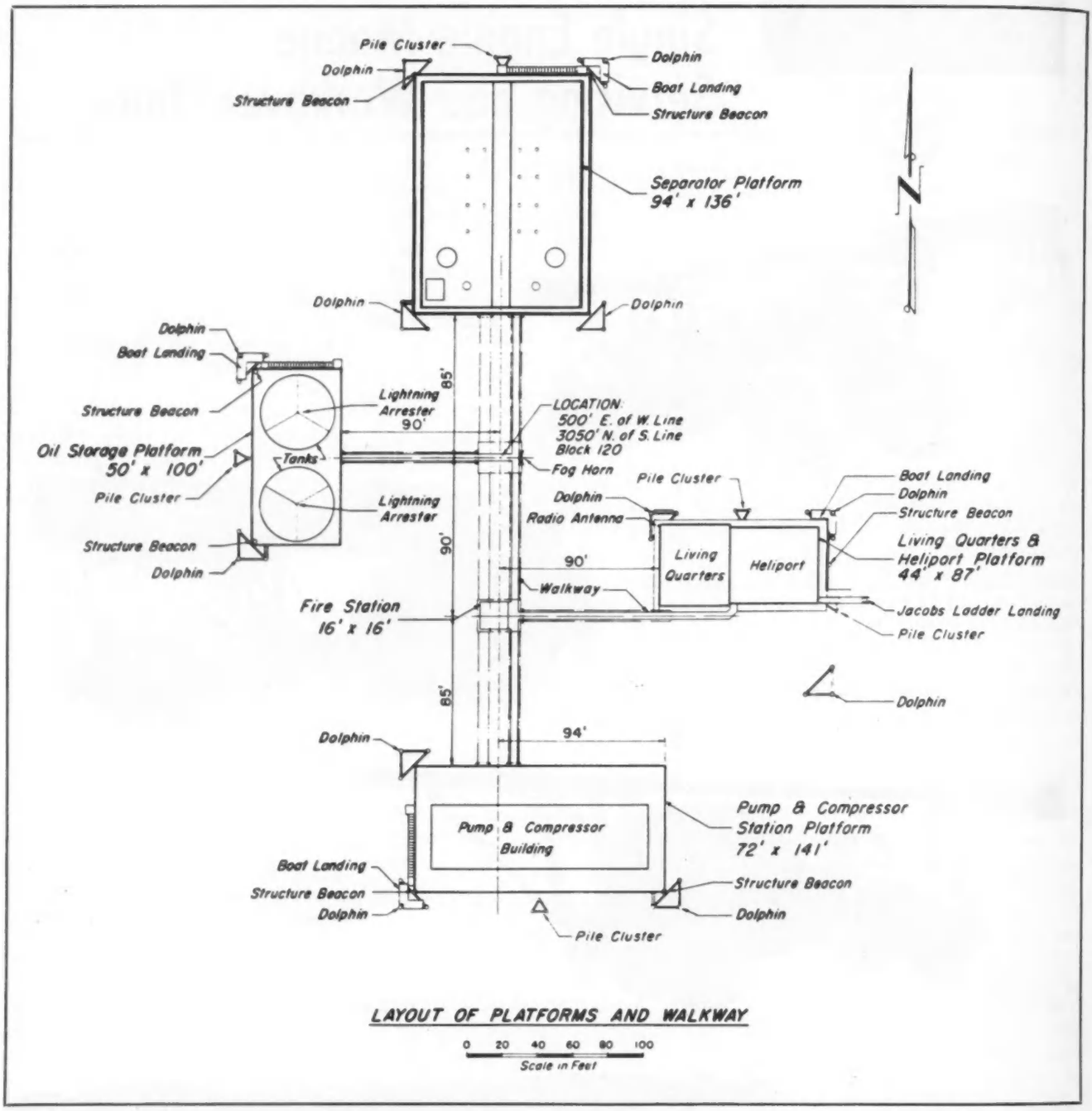



**FIGURE 1—This is a general layout of the platforms and walkways that make up the central separator station. The separator platform, storage tanks, pump and compressor building and living quarters offer complete facilities for handling offshore oil and gas.**

reservoir analysis is available. These separators are mentioned here in order to bring out the fact that the test vessel may be substituted for any of the multistage units in the bank, in the event one of the vessels fails.

A final separation unit is provided on the end of the separator platform so that production from weak flowing wells and gas lift wells may be accommodated. In addition, this unit separates as much gas as possible, reducing the gas carried over into the stock tank. Operating pressure here is reduced to the minimum necessary to flow oil into the storage tanks.

The test facilities include a test separator, positive displacement meter, and oil lines necessary to flow both into a tank for determining meter correction factors, and into stage separation units if desired. A meter prover will be installed and used when it become available. Gas measurements are taken through conventional orifice meter runs with standard differential and static pressure orifice meters.

In order to provide maximum safety, emergency shutdown valves of a pneumatic type have been installed to operate appropriate control valves whenever a high liquid level prevails in any of the operating vessels. In addition, controls are placed in the headers located in the center of the platform, which are set to close in the event of excessive or subnormal operating pressures. Dual safety valves have been installed on separators to insure relief of excessive pressures. Along each side of the sep-

**For successful "first-time" cementing** use the combination of BAKER CASING CENTRALIZERS to ensure ample clearance for placing a uniform body of cement around the casing—and BAKER WALL SCRATCHERS to scratch away the mud cake so that the cement will bond better with the exposed formation.

### YOU MUST HAVE "EFFECTIVE CENTERING FORCE"

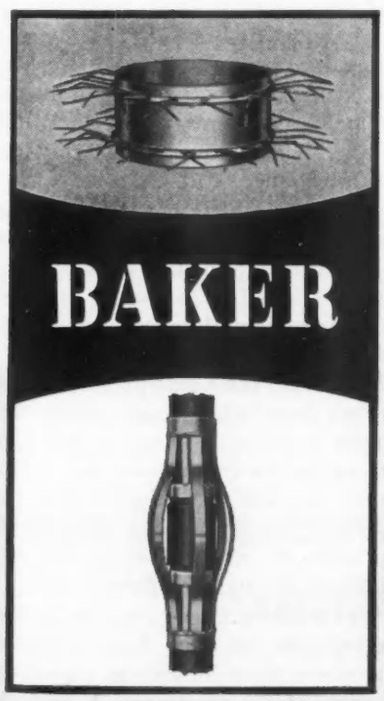
Baker Casing Centralizers have that *balanced combination* of proper spring *length* and proper *bowed height* ("reach") to provide Effective Centering Force *throughout the area to be cemented.* And, because each spring is pre-tested and pre-set in hydraulic presses, you have this Centering Force *at the cementing point,* regardless of depth or of "dog legs" in the hole.

### YOU SCRATCH ONLY THE SECTIONS TO BE CEMENTED

Baker Wall Scratchers perform a "controlled" scratching job, because the wires remain close against the casing while running in the hole, and *do not damage the vital filter cake* built up on sections through which the scratchers pass. Only when the "wall scratching" operation is started, do the overlapping wires (positioned in a *double* shell) *really go to work* scratching away the mud sheath and exposing the formation for far better bonding of the cement.

# OUTSTANDING COMBINATION

## FOR BETTER PRIMARY CEMENTING




Baker Wall Scratchers also meet your specific needs because they are available with either 4½-inch long scratcher wires, or with 2½-inch long wires. You can also select either the HINGE-LOK Type which is hinged for easy mounting, or the SOLID RING Type which is *slipped over the casing.*

Contact the Baker representative in your area and get complete details about these Baker aids to better cementing. He has first-hand field knowledge that will prove valuable to you.

## WALL SCRATCHERS

## CASING CENTRALIZERS

You can choose Baker Casing Centralizers exactly suited to each cementing job because they are available with various bowed heights of the springs to meet different casing programs—and there is the Baker Model "H" HINGE-LOK Type which is hinged for easy mounting, or Baker Model "G" SOLID Type which is merely slipped over the casing.

**BAKER OIL TOOLS, INC.,** Houston • Los Angeles • New York

arator platform, three quick-acting valves are spaced for the use of the operator who may find all means of escape cut off as a result of line breaks. By pausing long enough to open one valve, all control valves may be closed, thereby confining hydrocarbons to the maximum extent. Fire-fighting equipment has been provided in strategically placed carbon dioxide extinguishers, in addition to a sea water pump and distribution system which permits its use as required.

From the standpoint of economy, it was necessary to keep all control of production, with minor exceptions, on the separator platform. The only controls on the well platform are the storm choke and the hi-low pressure shutdown valve. If only the choke controls were left on the well platform, it is estimated that switcher and boat requirements would be two to four times as great as are the current needs.

Crude oil production leaving the separator platform is piped to the oil storage platform where two tanks with a combined capacity of 10,000 barrels are installed. No additional storage capacity is contemplated. These tanks are vented into the flare line for the central separator platform. Safety features include lightning arresters and a high level shutdown which backs up liquids in the last separation stage on the central platform which, in turn, actuates the control system to shut in production from all wells. An electrically driven centrifugal booster pump is installed on the oil storage platform and is used to transfer oil to the machinery platform at sufficient pressure to insure a flooded suction for the positive displacement pump.

The machinery platform includes positive displacement, inverted plunger pumps, a 3-stage gas compressor, air compressor, generators, water distilling unit, and rectifier for corrosion control. Figure 2 is a block diagram showing the arrangement of the machinery. Two plunger pumps, each driven by an internal combustion engine through a reduction unit, pump the oil directly into the 12-inch, two-phase line. Only one unit is now required; the other is used for standby. The gas compressor, a 10-power cylinder, 3-stage, engine-compressor unit, operates intermittently. Sizing of compression cylinders is in accordance with anticipated production rates for the near future. Operating pressures for each stage are held to the operating pressures of the stage separation units. Generator capacity is required to operate lights for living quarters and work area, navigation lights, the centrifugal booster pump previously described, engine cooling water pumps, and the rectifier. Two generator units are installed; either is adequate for the load. The water distillation unit provides sufficient fresh water for personnel and machinery operation and is considered adequate for future requirements. An air compressor is required to provide instrument air for the control system. A rectifier for corrosion control is employed, with a series of anodes hung directly beneath the machinery platform. This cathodic protection system has not yet reached equilibrium, and the degree of protection afforded is not established at this time. All indications are that it will be adequate, however.

Living quarters are provided for approximately 20 men, including a galley, dining room, office, supervisor's quarters, bunk house, and necessary storage space.

In view of the anticipated development in the field, arrangements had to be made for future expansion.

A 12-inch, two-phase gathering line is used to transport the oil and gas production ashore. This line was sized by use of calculations derived by Baker[2] and others, and additional data are being acquired on the performance of this line for future use. Provision has been made in Block 45 for a connection to take care of production from that field and for future development in that area, if required. Provisions have been made for mechanical cleaning.

**Operations.** Operating personnel required at the central platforms in Block 126 field include an operator, a helper, and a man responsible for well testing. In addition to the men actually assigned to the operation of the central facilities, there is a supervisor in charge, and five cooks, who complete the normal complement. Three switchers are also assigned whose responsibilities include daily inspection of the well platforms and minor maintenance thereon as required. The operator and his helper work a 12-hour tour and are relieved by a similar crew so that these jobs are filled 24 hours daily. The well tester works 12 hours daily; relief is not provided for him. The five cooks previously mentioned are responsible for providing meals at all hours and keeping the quarters clean. The supervisor is not assigned definite hours, but is subject to 24-hour call. Two production switchers work daylight hours, and one is on duty at night. It is contemplated that these men will undertake minor repairs as the work load permits, but major repairs must be done by additional labor provided for the purpose.

As with all offshore operations, it is necessary to keep a standby boat at the facilities platform, with a two-man crew on duty 24 hours a day.

**Operational Problems.** Several problems have been encountered in the operation of these facilities.

Production in this field is from the Upper Miocene formations. The formations are loosely consolidated, fine-grained sands. Upon initial completion, some of the wells produce a large quantity of sand. This is especially true in the shallow formations. As cumulative production increases from the individual well, the produced sand percentage decreases. The sand grains range in size from 0.001 inch to 0.012 inch. To combat this problem, gravel-packed screens and liners were tried. Their success has been varied. Sand consolidation treatments, under various trade names, are being considered. Individual sand knockouts installed at the wellhead on those wells completed in the shallow formations are proving fairly successful.

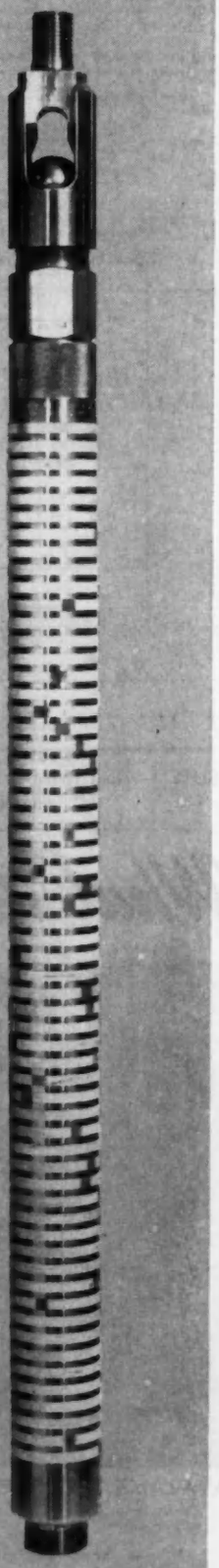
Another problem has been paraffin deposition. This has become critical in the tubing and flow lines of some wells. The effectiveness of several solvents and inhibitors is being evaluated for combatting this problem.

Presently, the paraffin must be removed from the tubing using mechanical cutters. The frequency of this operation varies from two to five times per well per year. Under our operating conditions, the loose paraffin must be removed from the well platform through the flow lines.

Pressure measurements, taken periodically on flow lines, measure pressure drop indicating the effectiveness of the treatment. A pressure

# Metal to Metal Wear...

## is the real villain in sucker rod pump troubles. It accounts for most of your repair and pump pulling expense.



## The Martin Idea...

for getting away from this trouble has always been to make use of the best available materials — *Natural Rubber* for the key material in plunger rings; *Synthetic Rubber* for the key material in resilient ball guides for cages.

The accurately grooved and drilled metal body of **The Martin Plunger** does not touch the barrel. Only the resilient rubber and duck rings contact the barrel. This material — with its great natural resistance to abrasion as well as its slipperyness-when-wet — has a much slower wearing action on the barrel. Most often your barrel will not need replacing. These rings have an amazing ability to take the kind of abuse that goes with oil well pumping, and this means longer runs. Plunger cost is reduced because replacing the rings costs only about one fourth as much as a new plunger, and this saving is, of course, added to the barrel saving and longer runs.

Patent No. 2,591,174

**The Martin Rubber Guide Cage** protects the ball from all metal contact except when it rests upon its seat. The ball is protected to such an extent that ball and seat life is usually doubled. The synthetic ball guide and stop cannot beat out because of its resilience. Its life is therefore much greater than any metal and you get this longer cage life in addition to better ball and seat life. The two guides are easily replaced when the occasion does arise.

No real capital outlay is required to get these benefits because the cost of Martin Plungers and Martin Cages is very much the same as you are now spending for replacements — sometimes less.

All regular or stroke-thru ROD PUMPS and TUBING PUMPS can be equipped with Martin Plungers. Martin Rubber Guide Cages are made in all sizes and styles. Write for our catalog No. 4; also see Composite catalog for 1956-57.

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*Manufacturer*

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For more data on advertised products, use Readers' Service Cards, last page.



drop greater than 10 psi per 1000 feet. Block 126 to shore. The line was

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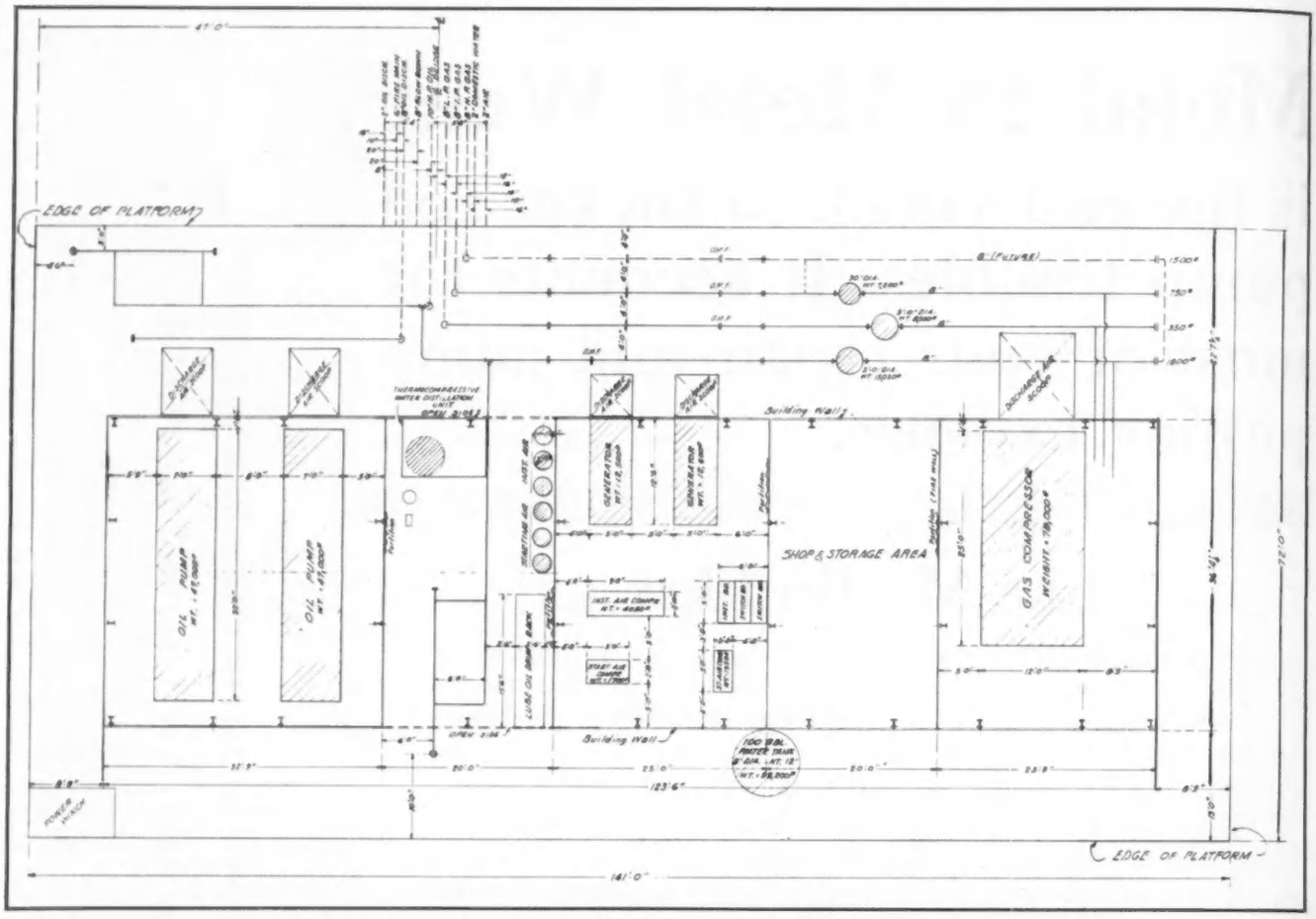


FIGURE 2—Floor space is at a premium on an offshore platform. The location of equipment in the pump and compressor station requires considerable thought and planning. This is also true on the adjoining platforms that make up the unit.


# What the WELL-DRESSED, MEDIUM-PRESSURE Wells are wearing

This well is equipped with the compact "Tee Base Type" HERCULES Duplex Stuffing Box and HERCULES "Type SO" Tubing Head. The Tubing Head is equipped with HERCULES original overhead packing arrangement and self-aligning hinged slips, making this a simple yet complete hook-up, featuring safety with simplicity and minimum of parts.

AVAILABLE THROUGH ALL SUPPLY STORES

If you have any problems involving well head equipment, a phone call, telegram or letter will bring you the desired information — quick.

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BOWEN presents a tremendous advancement in Rotary Jar construction

drop greater than 10 psi per 1000 feet of flow line is considered excessive.

A few of the wells in this field have produced water. Since no provision is made for water-oil separation on the separator platform the condition will be handled on a well basis as it becomes necessary. This decision was made for two reasons:

1. The installation of water separation facilities for the complete field would be a tremendous investment.

2. As wells begin to produce water, consideration is given to workover possibilities. If a workover is not economical at that time, a water knockout unit is installed on the well platform. In this manner, a small number of units can be utilized as needed.

The problem of emulsion treatment has not become critical. Studies are currently being made concerning possible treatment. Consideration has been given to treating the flow stream at the separator platform or the shore terminal.

Another major problem is the cleaning of the 12-inch line from Block 126 to shore. The line was cleaned before operations commenced, and is being purged with possibly greater regularity than would normally be necessary, since repairs to this offshore line would be both expensive and difficult. For better cleansing action kerosine is pumped ahead of and behind the scraper. Fortunately no appreciable accumulations of paraffin or sand were found; however, the periodic cleaning schedule that has been established is being maintained.


ACKNOWLEDGMENT

This article is based on a presentation at the 31st Annual Fall Meeting of the Petroleum Branch of the AIME, and Petroleum Engineers in Los Angeles, Calif., Oct. 14-17. The original title of the paper is: "Facilities Used in Gathering and Handling Hydrocarbon Production in the Eugene Island Block 126 Field Louisiana Gulf of Mexico." The writers wish to express appreciation to the managements of Magnolia Petroleum Company, Continental Oil Company and the Newmont Interests for permision to publish this paper. The assistance of many individuals who offered their constructive criticism and comments is also gratefully acknowledged.


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[1] Temple, C. V., and Pela, E. C: "Investigation of Production Facilities, Block 128 Field, Eugene Island Area, Louisiana Gulf of Mexico," Unpublished.

[2] Baker, Ovid: "Design of Pipe Lines for the Simultaneous Flow of Oil and Gas," presented at Fall Meeting, *AIME* Petroleum Branch (Oct. 19-21, 1953) Dallas.


**Errata**

The following alterations have been requested by David Cornell to his article "Unsteady State Flow in Gas Reservoirs" on Page 133, February 1, 1957, WORLD OIL.

Equation 6 should read:

$$p_f + p_s = \frac{m_1 p_f^2 P_{\theta_2}}{2\bar{p}} + \frac{(m_2 - m_1) p_f^2 P (\theta_2 - \theta_1)}{2\bar{p}}$$

The last quantity in Equation 7, $P (\theta_3 - \theta_1)$ should read: $P (\theta_3 - \theta_2)$

In the illustrative problem the symbol u should be $\mu$

The equation for $\Theta$ dimensionless time in the nomenclature should read:

$$\Theta \text{ dimensionless time} = \frac{4.39 \times 10^{-4} K \bar{p}\theta}{\mu \phi r_w^2}$$

Sub-Surface Protection
Against Wild, Uncontrolled Flow

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**BOWEN** *presents a tremendous advancement in Rotary Jar construction*

# SEALED LUBRICATION

**— practically eliminates wear**
**— greatly reduces servicing**
**— assures constant tripping tonnage**

NOTHING PROTECTS METAL SURFACES LIKE AN OIL BATH

The tripping mechanisms in SEALED TYPE "I" BOWEN ROTARY JARS are identical with those in the earlier types of Bowen Rotary Jars that have performed successfully the world over under all types of conditions for many years. These new Jars differ in that they are filled with oil and sealed top and bottom against the ingress of well fluid. With this arrangement, the moving parts of SEALED TYPE "I" BOWEN ROTARY JARS work in a bath of oil and advantages are produced thereby as follows:

**CONSTANT TRIPPING TONNAGE:** The tripping tonnage does not increase or decrease regardless of the presence of sand or oil in the well fluid. The tripping tonnage can be varied only at the will of the operator.

**LUBRICATION:** The oil bath extends the life of the Friction Slip and Friction Mandrel and practically eliminates wear on any other parts.

**INFREQUENT SERVICING:** These Jars can be used to perform several jobs before it is necessary to service them and the servicing procedure is simplified.

The floater is an important part in SEALED TYPE "I" BOWEN ROTARY JARS. It automatically moves up or down the Washpipe maintaining a pressure balance within the Jar and thereby avoids excessive pressures on the Seals.

SEALED TYPE "I" BOWEN ROTARY JARS are installed in fishing strings to enable the operator to strike heavy upward blows against an obstinate fish and knock it loose. They are also installed as safety devices in strings during testing, coring, reaming, drilling, sidetracking and washing-over operations. Their presence insures the operator of the ability to knock the string loose should it stick.

## *Outstanding Advantages*

**SEALED TYPE "I" BOWEN ROTARY JARS are *straight pull mechanical type rotary jars* which provide greater efficiency in jarring operations.**

**The ability of these Jars to strike heavy blows with a string completely free from torque eliminates any aggravating tendency to release the fishing tool below the jar. Torque free operation also reduces equipment wear and eliminates hazards.**

**The ability of these mechanical type Bowen Rotary Jars to operate successfully under all conditions has been proven in countless jobs throughout the world for many years. Since these jars are purely mechanical their tripping mechanisms do not depend upon a complicated series of packing elements. Hence their ability to deliver heavy blows is absolutely unimpaired by packing failures, abrasive elements in the circulating fluid or high temperatures.**

**These Jars will deliver the same heavy upward blows regardless of whether the string is elevated slowly or with great rapidity.**

**These Jars feature oversize circulating holes to permit unlimited use of wire line tools and to allow passage of large volume of fluid.**

**After considerable service, the wearing parts of SEALED TYPE "I" BOWEN ROTARY JARS can be replaced easily and economically and the tool will regain all the properties of a new one.**

## SEALED TYPE "I" BOWEN ROTARY JARS

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# International Section

## Caltex Line to Link Sumatra Fields, Port

**Duri and Bekasap oil fields—and later the Minas producing area—will be connected with deep-water tanker terminal to be built on the MaLacca Strait. The project is expected to be completed early in 1959.**

By H. T. BRUNDAGE
World Oil Staff

Caltex Pacific Oil Company has begun an important pipe line project to link Duri and Bekasap oil fields in Central Sumatra to a deep-water tanker terminal to be built on the northeast coast at Dumai on the Malacca Strait. A 30-mile, 30-inch pipe line will be built by International Bechtel, Inc., of San Francisco, Calif., contractors, between Duri field, located about 40 miles northwest of Minas field, and the port of Dumai, located opposite Rupat Island.

This crude line, to be built through very difficult coastal swamp country, is scheduled for late 1958 or early 1959 completion. It is unlikely that production from Duri and nearby Bekasap oil fields will utilize the full capacity of the system. Eventually it is expected that a large-diameter crude line will be built along the roads (see map) from the prolific Minas field to connect with the Duri-Bekasap-Dumai system. A spur linking Bekasap with Duri field, less than ten miles away, of about 14-inch diameter, definitely is planned. The Minas-Duri line would be approximately 40 miles long.

Crude production from Minas field, a major reserve, continues to rise steadily. Production rose from an average of 61,000 barrels daily in 1955 to around 125,000 barrels per day in March, 1957. Crude is loaded into river tankers of 24,000 and 27,000 barrels capacity at Perawang terminal on the Siak River, and is hauled almost 100 miles downstream over a narrow, meandering route to the Pakning marine terminal opposite Bengkalis and Padang Islands, opening into the Malacca Strait (See World Oil, page 273, October, 1956).

These tankers, working around the clock, make about 125 trips monthly, with seven tankers in service during March, 1957. Traffic on the narrow, meandering Siak River is increasing. Despite this congestion, Minas field production has recently put Caltex in the lead among the three firms producing crude in Indonesia, despite the fact that Caltax did not commence production until 1952.

By contrast, Royal Dutch Shell has been producing Indonesian crude since 1893 when Telaga Said Darat went on production. Standard Vacuum Oil Company's Indonesian production dates from shortly after World War I.

Caltex had 95 wells producing at the end of 1953 at Minas field, and has been drilling development wells at the rate of about 20 annually in recent years. The field has been well delineated, measuring about 15 miles parallel to its northwest-southeast axis and averaging about five miles in width. One rig continues active drilling inside locations. Miocene sands approximately 2500 feet in depth at Minas yield 35 gravity oil with a paraffin content varying between 21 and 25 percent and with a pour point of 95.

Duri field, to be put on production upon the completion of the new line, was discovered just before the outbreak of World War II. Lenticular Miocene sands at only 800 feet of depth at Duri yield paraffin-base 22 gravity crude with a pour point of 45 to 50. The recently-enhanced world market for heavy crude is a factor in the decision to produce the field.

In early 1957, active development of the Duri field was getting under way. Two light, mobile, diesel powered rotary rigs were active, and 19 wells had been completed. In the Duri area, about 100 inches of rain falls annually. The wet, yet heavily vegetated, center of the oil field area is very difficult ground for moving and locating a rig, so it has been initially expedient to develop the field by taking advantage of any existing high ground. As a result of the difficult surface conditions, initial drilling is somewhat localized, and the productive potential of Duri field is not yet known. The wells apparently will have to be pumped.

Bekasap field, located west of Duri, was discovered in 1955 and is Caltex' most recent find in Indonesia. The productive horizon is Miocene sand at about 3000 feet. The crude is generally similar to Minas. Only one productive well has been drilled and Bekasap's potential is not known either. But further drilling is planned, with a rotary rig to be moved in late 1957.

Two fields, located between Duri and Minas, at Pungut and Sebanga, have a total of fewer than ten wells between them and appear to be controlled by small, localized structures.

By March, 1957, Bechtel was build-

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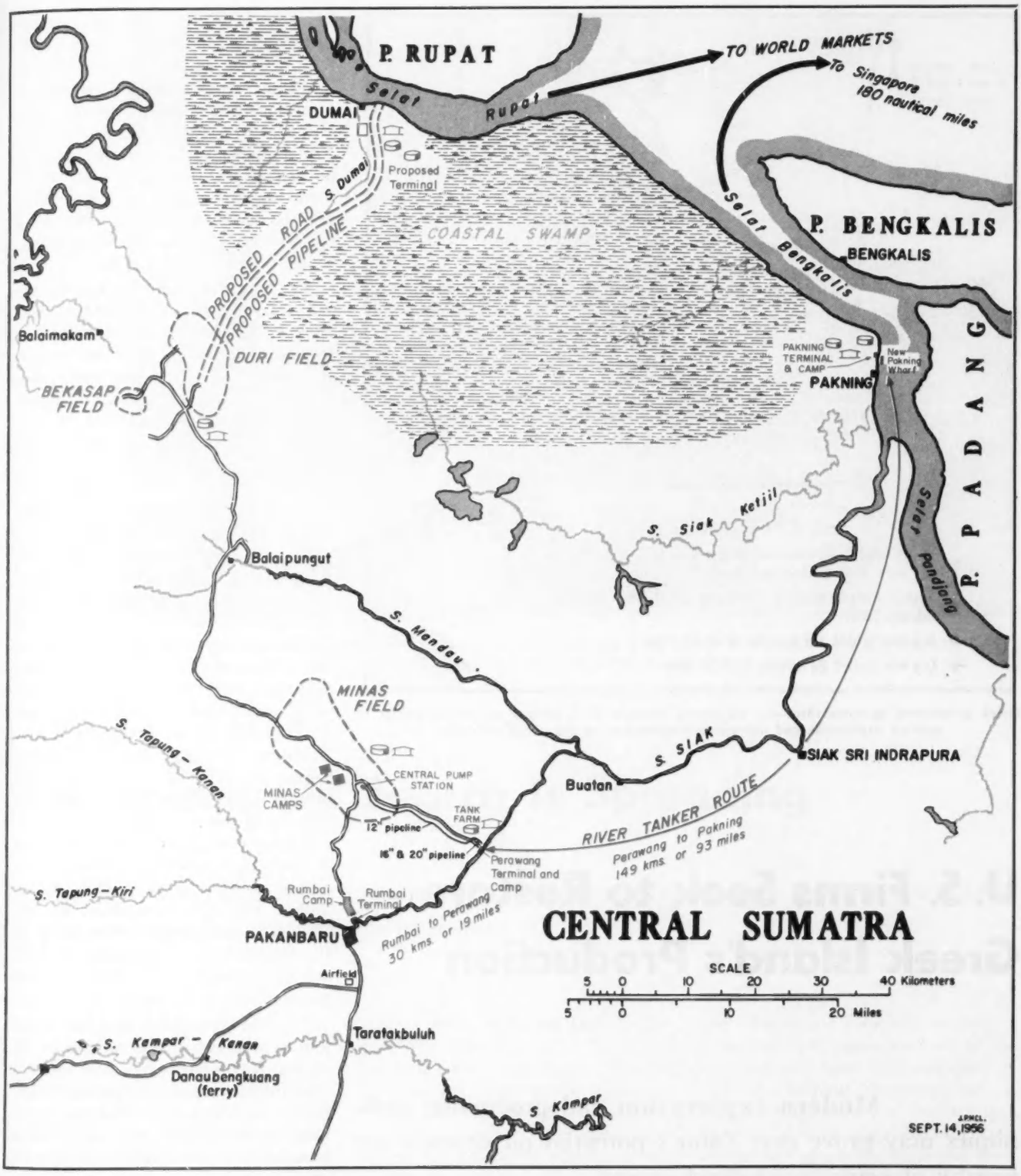
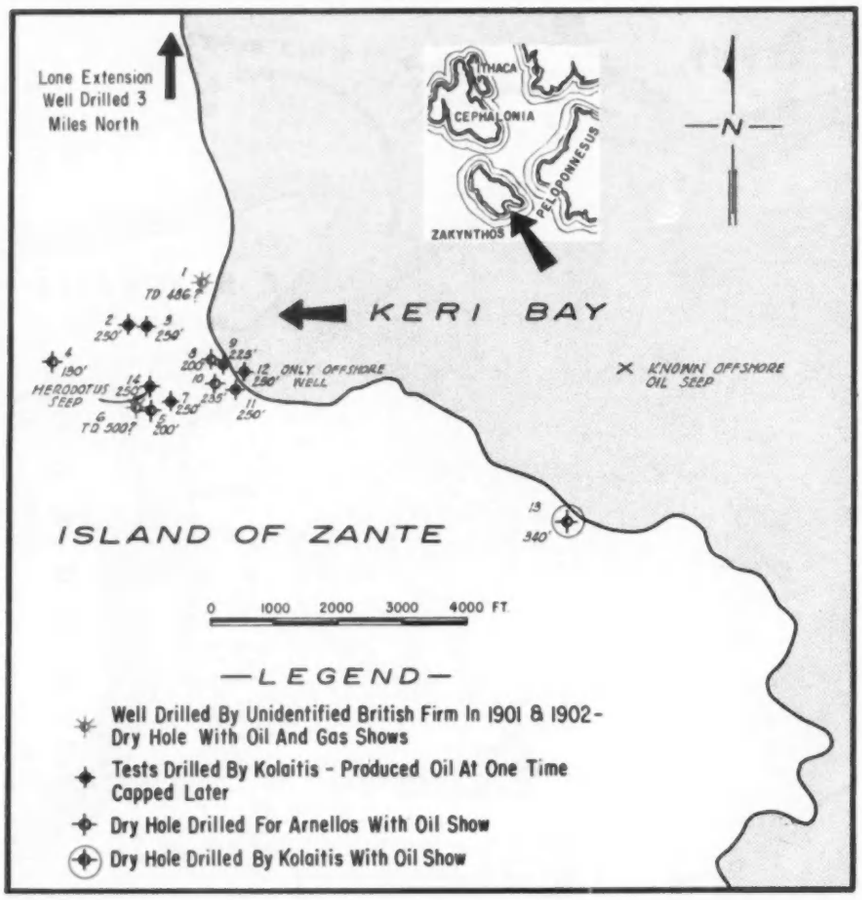



**This proposed oil pipe line, upper left, which will connect Caltex Pacific Oil Company's Duri and Bekasap oil fields in Central Sumatra to o projected tanker terminal at Dumai is expected to be connected eventually with a pipe line from the Minas oil field.**

ing camps and was engaged in other preparatory work for pipe line construction. Electric-weld pipe of both U. S. and European manufacture will be used. No coating or wrapping is planned for this pipe line, which will be laid above ground.

One main pumping station at Duri is planned to utilize large centrifugal pumps powered by diesel-type crude burning engines. The eventual throughput rate of the system will depend on the outcome of the development of Duri and Bekasap fields, and on the possibility of Minas field's being connected with the new system to replace the difficult Siak River transportation outlet. Large storage systems will be built, and a deep-water terminal at Dumai will be constructed to complete the project. —**The End**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**Greek government approves three-way agreement between U. S. private capital companies to conduct exploration and development operations on the island of Zante.**

# U. S. Firms Seek to Restore Greek Island's Production

**Modern exploration and production techniques may prove that Zante's potential oil deposits are worthy of commercial development.**

U. S. CAPITAL now is being invested in a venture intended to apply modern exploration and production methods to restore and expand crude oil production which has taken place intermittently on the island of Zante since about 450 B. C., when the ancient Greeks, according to tradition, used asphalt from seeps to caulk their ships. During 1901 and 1902, a British company is said to have drilled for oil on Zante. Between World Wars I and II, a Greek oil operator produced crude from time to time from shallow wells.

During World War II, producing operations were taken over by Italians, and later by the Germans under Army supervision. After the invasion of Sicily by Allied forces, the Germans detonated most of the production facilities on Zante in use prior to October, 1944, and evacuated the island.

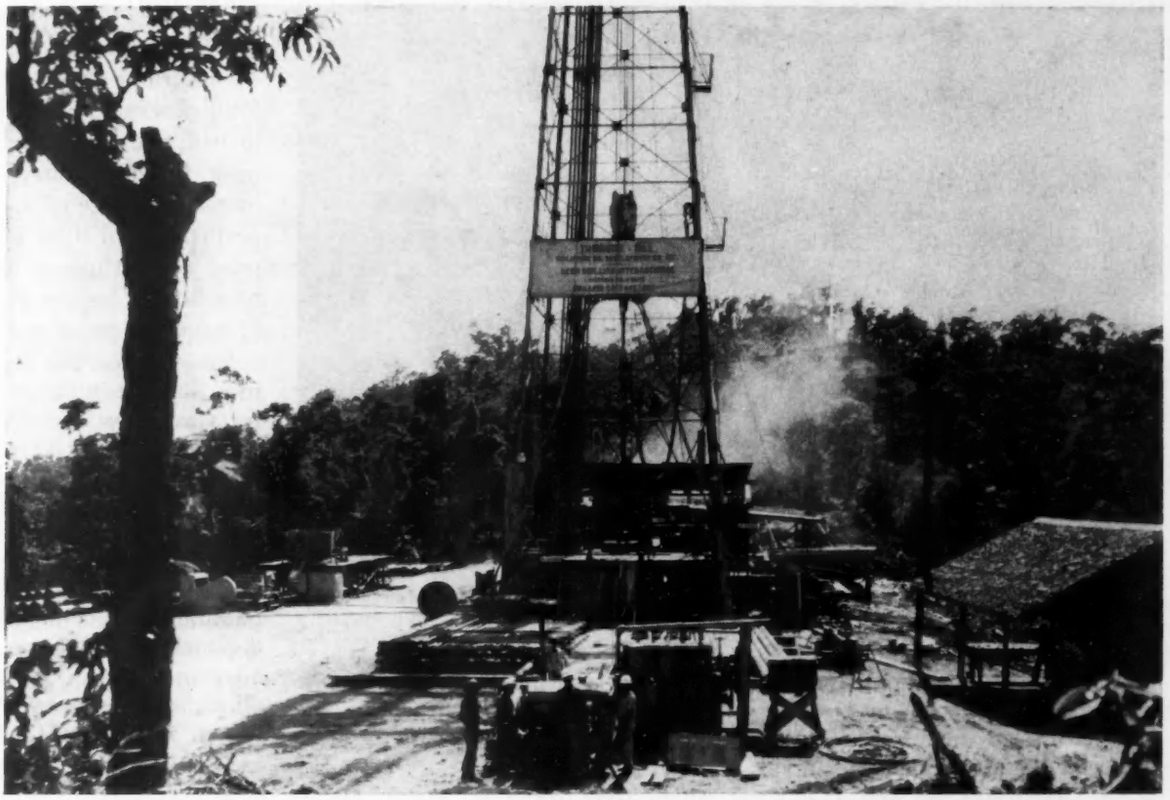
The Island of Zante (ancient name: Zakynthos) is the southernmost island of significant size in the Ionian Sea, located about 20 miles off the southwestern tip of the Greek mainland. It is 22 miles long in the northwest-southeast direction, parallel to the trend of the Adriatic Sea, and is about ten miles wide. Proven crude oil deposits at Zante are roughly on trend with Albanian oil fields about 200 miles to the north-northwest.

Israel Mediterranean Petroleum, Inc., and Pan-Israel Oil Company, Inc., announced in January, 1957, that approval had been received from the Greek government to an agreement entered into with American-Grecian Oil Company, Inc., for exploration and development of petroleum concessions covering Zante. American-Grecian, Israel Mediterranean and Pan-Israel represent 100 percent U. S. capital firms. American-Grecian is incorporated in Maryland, the other two in Panama. Total area of current concessions amounts to about 120,000 acres (187.5 square miles). The three companies are applying for additional concessions in the Ionian Islands, including offshore acreage adjoining the Keri area at the south end of Zante Island.

Israel Mediterranean and Pan-Israel jointly will carry out operations on Zante. James Ogilvie is the drilling superintendent. A Canadian from Calgary, Alberta, he will supervise four Israeli drillers who have been brought to Zante together with the stratigraphic rig pictured in WORLD OIL, Feb. 1, 1957, page 168, Figure 4, where it was being used for core drilling operations near the Heletz field in Israel. The rig is capable of drilling to about 2300 feet. Andre Dumestri, a Frenchman, is chief geologist for the operators at Zante.

The island appears to have an excellent oil potential. Commercial production has been obtained in the

*(Continued on Page 242)*



This is the Philippine Oil Development Company's Tumauini 1, a test being drilled at Tumauini in Isabela province. Drilling contractor is Kern Drilling International of Long Beach, Calif.

# Philippines Oil Search Is Spreading

**Government has granted 49 concessions covering more than 6 million acres as private capital operations are intensified.**

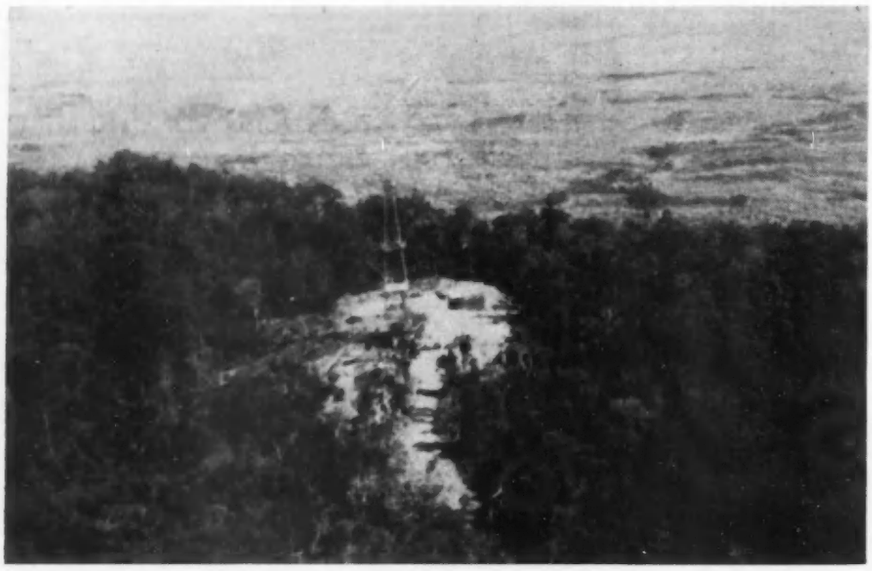
AN INTENSIVE SEARCH for oil by Filipino as well as U. S. interests currently is under way in the Philippines. Forty-nine concessions involving more than 6 million acres have been granted by the Philippine government. And there are encouraging signs that more private capital U. S. companies will join in the search this year.

Present discoveries of oil seepages and gas emanations, as well as encouraging results of geological surveys, have spurred this greater interest in the search for oil in various parts of the archipelago. Among the areas where oil seepages have been located and the presence of oil is suspected are the Cagayan basin, the Central plains of Luzon and the Ilocos region, the Island of Cebu and the Iloilo basin in Panay, Bondoc peninsula in Quezon province and the Agusan-Davao and Cotabato basins.

Oil exploration teams have conducted magnetometer surveys of the regions involved, i.e., the Aero Service Corporation of Philadelphia, Penn., which conducted the survey for San Jose Oil Co., Inc. It also has made preparations for gravimetric and seismic surveys. The San Jose Oil Company, Inc., a subsidiary of the San Jose Petroleum of Panama, with U. S. stockholders, had concessions executed but not yet released amounting to approximately 2.5 million acres in Central Luzon, Panay and Mindanao. Personnel to form a geological field party for each of the areas already have been engaged.

Acoje Mining Company, Inc., a Filipino corporation, is conducting a diamond drilling operation in its concession in Cebu while preparing for a geological reconnaissance and aerial mapping surveys as its additional application for concessions in Luzon, Leyte and Mindanao are granted.

The trend towards more oil exploration has grown out of the fact that the Philippines is the missing link in the chain of oil producing islands on the edge of Southeast Asia. Since 1955-56, the tendency has been toward a more thorough and intensive search through geological surveys



An air view of Philippine Oil Development's drilling site shows a sharp contrast in terrain—from dense forest to open hilly expanses.

and oil drilling operations. Large oil interests, backed mostly by U. S. capital, have been investing large sums to speed up the drilling operations. U. S. technicians, as well as equipment, have been imported by the various companies (See table).

Among the more recent moves in the search for oil is that of the Standard Vacuum Oil Company, which has invested $2 million in equipment alone to drill for oil in its Cagayan Valley concessions. Stanvac holds eight oil concessions of approximately 971,000 acres. C. A. Larsen, Stanvac's general manager, said the firm had planned to begin drilling on March 15 at Faire (Cagayan). The Stanvac exploration party was to have included nine geologists and a drilling crew of 14, as well as other technicians and laborers.

Philippine Oil Development Company, another Filipino enterprise, was the first oil company to start actual drilling operations last year in Tumauini, Isabela. A second hole was scheduled to be drilled in Cagayan Valley in April as soon as the bridges to the site were repaired and the new equipment was transported to the area. In its Cagayan valley concession, where there is overlapping of territory, PODCO has made an arrangement with Stanvac in which one has rights in the other's property and mutual benefits are derived from assistance and interest in each other's operations.

Among the other efforts in the search for oil are those of the Philex Mining Company, an American corporation, which has conducted a magnetometer survey of oil concessions in La Union, the results of which were being evaluated. Philex also holds concessions in Ilocos Sur and Abra.

At present, the only oil refinery in the country is that run by Caltex in Batangas province which refines imported crude. Caltex employs an average of 604 men in its plant and general personnel, excluding its merchandising force.

Among the other companies which contemplate setting up their own oil refineries in this country are Standard-Vacuum Oil Co. and the Shell Company. The Philippine government has shown interest in these projects because of the benefits they will bring to the country which is now accelerating its industrialization program. The Philippines will be greatly benefited by this proposed petroleum production since the Philippines has been importing petroleum products valued at approximately $55.5 million annually for the last three years.

Construction of refineries in the Philippines also will provide a means to ease the high rate of unemployment in the country as well as to hasten the pace of industrialization, particularly in those fields which depend on petroleum and which are now limited by the prohibitive price of imported petroleum products.

Evidence of the growing government interest in the petroleum industry was the statement of Philippine Bureau of Mines Director Benjamin M. Gozon about the late President Magsaysay's interest in developing and intensifying the search for oil. Gozon said it was not only the government which had shown interest in the exploration for oil but also private individuals and investors, who became oil conscious. An application for an oil concession was even filed recently for an area near Manila.

The main problem encountered by concessionaires in oil exploration has been transportation and travel facilities. In the Cagayan Valley explorations, transportation of necessary drilling equipment has been delayed by bridges which have been washed away by the typhoons. Also, in some areas, the drilling sites are not accessible to motor vehicles—necessitating the use of work animals, like the native carabao. The lack of experienced technicians has been solved by bringing in U. S. experts. Some companies, like San Jose Oil, intend to offer scholarships for the training of Filipino geologists.

The regulations which cover the granting of oil concessions by the Philippine government, which owns the petroleum resources, are embodied in the Petroleum Act of 1949 (Rep. Act No. 387). Under the Act, concessions to explore, develop and develop petroleum resources are

**Concessions Granted by the Philippine Government**

| OIL COMPANY | Number of Concessions | Number of Acres | Location |
|---|---|---|---|
| Standard-Vacuum Oil Company | 8 | 970,877 | Cagayan valley |
| Caltex (Philippines) Inc. | 7 | 1,247,560 | Cagayan valley |
| Acoje Mining Co., Inc. | 1 | 135,250 | Cebu |
| Philippine Oil Development Co., Inc. (PODCO) | 11 | 1,445,789 | Cagayan and Isabela |
| Benguet Consolidated | 2 | 264,247 | Lanao and Bukidnon |
| White Eagle | 3 | 524,007 | Cagayan, Cebu and Lingayen Gulf |
| Philex Mining Company | 2 | 253,822 | Ilocos Sur and Abra |
| Luzon Stevedoring Co. | 1 | 60,543 | Leyte |
| San Jose Oil Co. | 14* | 2,474,244 | Central Luzon, Panay and Mindanao |
| Total | 49 | 7,376,330 | |

* Concessions had been executed but not released.

granted to those who possess the following qualifications:

• In case of an individual, he shall be a citizen of the Philippines, be of legal age, and have the capacity to contract obligations.

• In case of an association of individuals, it shall be either a partnership or a corporation duly organized and constituted under the laws of the Philippines, at least 60 percent of the capital of which is and shall at all times be owned and held by citizens of the Philippines. However, during the effecting date of the Parity Amendment to the Philippine Constitution—but not beyond July 3, 1974—citizens of the U. S. and all forms of business enterprises owned and controlled, directly or indirectly, by citizens of the U. S. shall enjoy the same rights and obligations under the provisions of the aforesaid Petroleum Act of 1949, in the same manner as to and under the same conditions imposed upon citizens of the Philippines or corporations or associations owned or controlled by citizens of the Philippines.

In addition to these qualifications and before any concession is granted, an applicant is required to present satisfactory evidence that sufficient finance, organization, resources, technical competence and skills necessary to conduct the operations are available to such applicant.

**• Filing of Concession Application.** Further processing includes these steps: Application for exploration concession (B. M. Forum No. 73) duly accomplished in quintuplicate must be filed with the Director of Mines, Manila. Copies of the form may be obtained in the Bureau of Mines, Manila, without charge.

**• Processing of Application.** If the Director of Mines finds the application in order and the applicant duly qualified, he will forward the said application, together with his findings and recommendations, to the Secretary of Agriculture and Natural Resources.

**• Publication.** A notice of the application for exploration concessions is published once a week for three consecutive weeks in the Official Gazette and in any newspaper of general circulation in English in the City of Manila.

A copy of the said notice of application also is posted on the bulletin boards of the Bureau of Mines, Manila, and in the District Mining Office and Mining Recorder of the province where the land covered by the application is located.

During the period of publication, an adverse claim stating the nature and grounds thereof may be filed with the Director of Mines. If no adverse claim is filed within the said period of publication, it shall be conclusively presumed that no such adverse claim exists and thereafter no objection from third parties to the granting of concessions will be heard.

**• Issuance of Deed of Exploration.** The contract of concession will be executed by the Secretary of Agriculture and Natural Resources for the Republic of the Philippines and the concessionaire.

The search for oil in the Philippines has increased tremendously since 1955-56, when exploration started. The government, notably the late President, has expressed great interest in the exploration for oil, indicating all-out government support for the program. Recent legislation in Congress has tended to favor the oil interests and to guarantee adequate government aid. An example is the recent introduction in Congress of a legislation to amend certain articles of the Petroleum Act of 1949.

The legislation seeks:

1. To assure extension of an exploration concession if the concessionaire has complied with the Petroleum Act, the regulations, and the terms and conditions of the concession contract.

2. To allow the tax free export of equipment, machinery, instruments, materials, supplies and accessories, imported free of customs duties for use in the concession.

3. To provide a system of arbitration.

4. To authorize the transfer and assignment of concessions under certain conditions.

Prospects for the petroleum industry are bright for 1957 with the major oil companies contemplating more exploration projects as well as the beginning of drilling in promising areas. Standard-Vacuum has announced its intentions of improving existing facilities. Another of its projects is its own oil refinery to be established in the Philippines as soon as plans are completed, an enterprise in which it has a parallel in Shell, which also plans to set up a refinery here.

In the stock market, the brisk trade on companies with oil properties is indicative of the awareness of the petroleum potentialities of the country.

Meanwhile, the Texaco Overseas Petroleum Company and the California Asiatic Oil Company, two big U. S. oil firms, have sent to the field in the concession areas, where they have joint interest, a geophysical party and a geological reconnaissance survey party. **—The End**

**The Petroleum Oil Development camp for the Tumauini 1 crew is 1½ miles from the rig.**

## U. S. Firms Seek to Restore Zante Production

*Continued from Page 238*

past through methods that have been either ill-equipped or temporary in nature due to hostilities prevailing at the time. All previous production has been from very shallow beds—at about 250 feet. Most of the island's area remains to be prospected adequately and drilled. Abundant oil and gas seeps occur, both onshore, and, in at least one instance, immediately offshore.

None of the offshore areas has been explored, though in places the depth of water drops off abruptly to 100 feet and deeper. The exposed geologic section is largely composed of Tertiary and upper Cretaceous marine limestones, marls, clays and gypsum, with a few intermixed beds of sand, cherts and other sediments. At least 6500 feet of sedimentary section is indicated on the surface.

Structurally, the island is generally fraught with faults, high-angle dips, and other indications of conditions favorable to oil accumulation. There may, in fact, be a little too much structural deformation of the sediments. Surface evidence indicates that there has been very recent activity along fault planes exposed. The island has been subject to frequent earthquakes. Ironically, an earthquake that shook Greece in 1953 not only emphasized the probability of renewed activity along fault planes at Zante but also caused a fire that destroyed all the records of the wells on Zante formerly operated by the independent Greek producer, Kolaitis.

One of the earliest comprehensive studies of the geology of the Island of Zante was presented by Arthur Wade, D. Sc., to the Institution of Petroleum Technologists in London, England, Dec. 8, 1931. In this report, results of an analysis of two samples of crude were included. Some interesting attributes of the samples of crude examined are as follows:

| | Sample Number One | Sample Number Two |
|---|---|---|
| Specific gravity at 60° F. | 1.010 | 1.0046 |
| Water Content (IPT method) | 0.8 percent | ..... |
| Gasoline content | 0.7 percent | 1.0 percent |
| Kerosine content | 14.4 percent | 14.0 percent |
| Lubricating oil content | 33.0 percent | 43.0 percent |
| Asphalt content | 51.1 percent | 42.0 percent |

In the past, some of Zante's oil wells have flowed as much as 250 barrels per day at shallow depths but have been capped from time to time for no other reason than that there was insufficient market for such a heavy crude. Now that fuel oil, lube oils and asphalt are more in demand, this crude should find a better market situation. It is hoped, too, that deeper wells expected to be drilled on Zante will discover lighter crudes of greater monetary value.

A later report submitted to American-Grecian Oil Company by C. A. Mulholland, consulting petroleum engineer of St. Louis, Mo., summarized previous literature pertaining to the oil prospects of Zante together with his own observations acquired during a visit to the island in December, 1955. Among the many things noted in this report was an account of a well reportedly drilled by a British firm in 1901 to about 500 feet which obtained "light, volatile oil."

Another important point that was made concerns a well drilled and completed by Kolaitis three miles north of Keri Marsh, where the original oil seep noted in the writings of Herodotus and all the other wells that have been produced on the island at one time or another are located. The extension well flowed heavy oil, presumably from the same Miocene pay productive at Keri at about 250 feet. The accuracy of records and of the measurements recorded probably is insufficient to allow any good analysis of fluid levels. But since the specific gravity of the shallow oil is greater than that of water, it appears that the reservoir should not follow the production characteristics of normal oil reservoirs in which the oil is lighter than water.

Israel Mediterranean and Pan-Israel and Pan Israel are obligated to drill a minimum of 14,760 feet of hole during the period 1957-60, but officials representing the operating companies expect to drill at least twice that much footage. After the operators have spent $150,000 on this venture, American-Grecian will be required by the agreement to bear 50 percent of all additional costs.

—**The End**

## German Drilling Activity Rises After Decline

Drilling footage of German oil companies, which had declined slightly in December, increased in January. The increase stemmed primarily from extension wells drilled within the productive areas in proven fields. Total footage drilled last January was 203,038 feet, or about 16,400 feet more than in January, 1956.

Twenty-three successful wells were recorded in January, including the wildcat Hardesse 4 (Hannover) and the successful extension wells Hebelermeer 7a (Emsland), Ampfing 15 (Bavaria), and Schwedeneck 8 (Schleswig-Holstein).

**Footage Drilling in January, 1957**

| Type of Well | Footage |
|---|---|
| Exploratory | 49,596 |
| Extension | 32,205 |
| Production | 115,000 |
| Service | 6,237 |
| Total | 203,038 |

## Long Kuwait Stepouts Indicate New Reserves

Kuwait Oil Company has announced its current program for proving up new crude reserves indicated in northern Kuwait, following discovery of a reported 1200 to 1500 feet of Cretaceous oil sands at Raudhatain in 1955. Guided by results of a seismic survey completed in 1956, Kuwait Oil Company had commenced the drilling of three wells which, if completed as expected, would prove up a new field more than 20 miles long, very likely the equivalent of reserves proven in the Burgan-Magwa-Ahmadi field area in southern Kuwait.

Confirmation test, Raudhatain 2, located 1.8 miles southeast of the discovery, was drilled to 9685 feet and seven-inch casing was cemented at 8778 feet. The well was shut in because "production facilities were not available in the northern area." Sabriya 1, nine miles southeast of the discovery, was spudded August 11, 1956, and had reached 8450 feet by the end of the year, with seven-inch casing set at 8437 feet. Plans called for deepening this test to explore the Zubair sands. Bahra 2, ten and one-half miles south of Sabriya 1, was drilled to 8488 feet with 7-inch casing cemented at 7789 feet and shut in.

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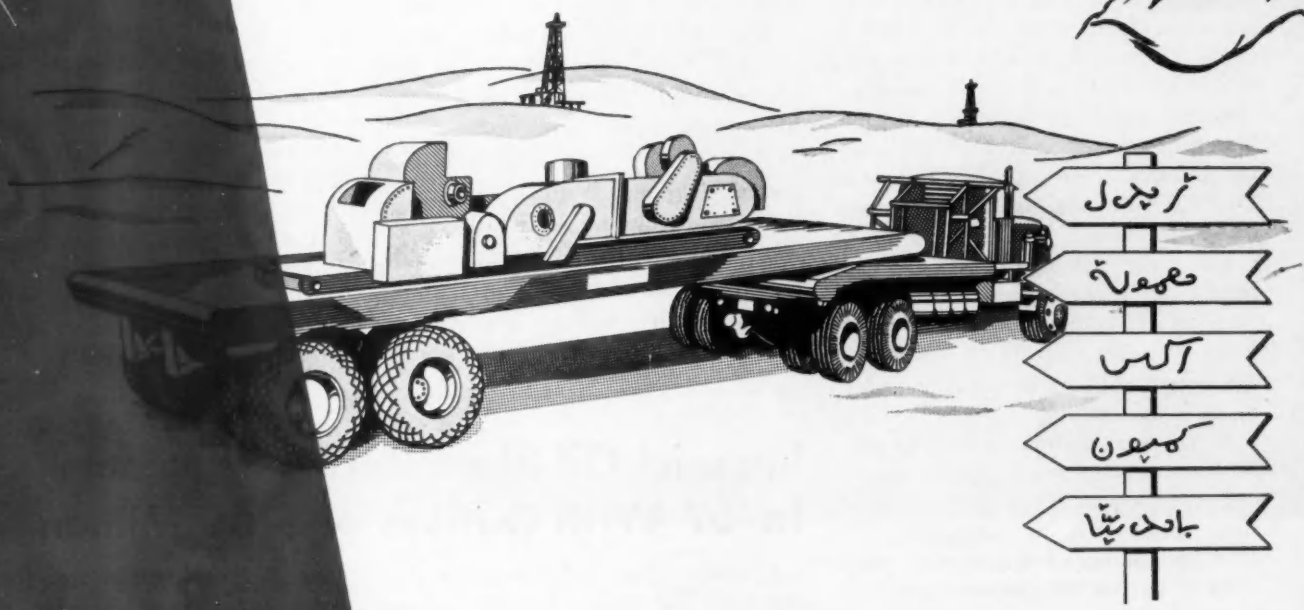


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# Oil Found in 5 More Wells In Israel's Heletz Field

Oil has been discovered in five more wells in Israel's only producing oil field at Heletz, adjoining the Gaza Strip. One of the new wells, Heletz 16, contained 44 feet of oil-saturated sands, by far the best pay yet found.

A drillstem test at 5008-5084 foot depth was run and clean 32.1 gravity crude filled the pipe to the rotary table in 49 minutes.

Hillel Dan of Tel Aviv and Xiel Federmann of Haifa, managing directors of Israel Oil Prospectors Corporation, Ltd., who recently visited the U. S. for a series of meetings with the U. S. investors in the Israel oil venture, issued the latest report. The investment group is headed by Samuel Friedland, industrialist, and Max Orovitz, public utility executive, both of Miami Beach, Fla. The company operates the Heletz field and other oil license areas in Israel jointly with Lapidoth Israel Petroleum Company, Ltd.

Other highlights in the Dan-Federmann report were:

1. Oil production in Israel currently is at the rate of 400,000 barrels per year, or almost 1100 barrels daily, from nine wells, as compared with 1956 production of slightly more than 152,000 barrels, or approximately 415 barrels daily.

2. Thirty to 40 wells will be drilled in Heletz field this year.

3. Fifteen wildcat operations will be carried out in other areas where the companies are licensed to operate: on the western shore of the Dead Sea; in the Negev desert; at Negba, north of Heletz; and at Beeri, just south of the field.

Since oil was first discovered at Heletz in 1955, 17 wells have been drilled, nine of which currently are producing. The nine others will go on production as soon as completion equipment can be obtained. Four wells currently are being drilled at Heletz, one near the ancient Biblical city of Sodom, near the Dead Sea, and a wildcat in the Tsenifim license area, deep in the Negev, 40 miles north of the Gulf of Aqaba port of Elath.

Another wildcat drilled at Beror Hayil, 1½ miles southwest of Heletz, first was thought to be a dry hole but subsequent tests proved the existence of porous oil sands.

Concerning the nine wells being readied for completion, No. 4 is at the extreme western edge of the field, with thin, calcareous sands and low pressure. Recent tests indicated the well may flow after swabbing without pumping. Nos. 7 and 8 require squeezing and are awaiting the arrival of equipment. No. 13 will be a pumper and the pump was being installed. Nos. 14 and 15 were awaiting a shipment of 2⅜-inch tubing, as was the major well, No. 16. Nos. 17 and 19, recently brought in, were scheduled for drill stem tests.

If the Heletz field reaches its estimated yield of 1.8 million barrels of crude annually by year-end, or almost 5000 barrels daily, it will be capable of furnishing more than 25 percent of the nation's domestic requirements.

## Further Testing Planned In Nigerian Exploration

A wildcat well near Afam, 20 miles east of Port Harcourt, Nigeria, encountered oil and gas during the initial stages of testing. Since only the lowest prospective sand layer in the well was tested, the full potentialities of the well cannot be determined.

However, preliminary results did indicate that the discovery may be worth appraising by further drilling. Location for a second well was being prepared, about three-fourths of a mile north of the first well, and spudding in was expected to be speeded.

The search for oil in Nigeria is being conducted jointly by The British Petroleum Company and the Royal Dutch Shell Group.

At the site of a previous discovery, Oloibiri, test production of oil was scheduled to begin about mid-1957 to get information on the reservoir's expected rate of decline.

This data will determine whether sufficient oil can be recovered from Oloibiri to cover the cost of full-scale production operations.

# Imperial Oil Plans Record Program In '57 With Outlays of $160 Million

Record outlays of $160 million during 1957 for exploration and capital facilities are forecast in Imperial Oil Limited's annual report for 1956. Net earnings in 1956, after provision for income tax, were $69,098,692. This is tantamount to 11.2 percent greater than in 1955 and is the highest in the company's history.

J. R. White, president, said increases in the volume of business and income during 1956 directly reflect the company's high level of expenditures for exploration and for plants and equipment. These outlays amounted to $134 million last year and were essential "to meet not only the increasing energy requirements of the country, but also the continuous demands of technical obsolescence, new products and higher product quality."

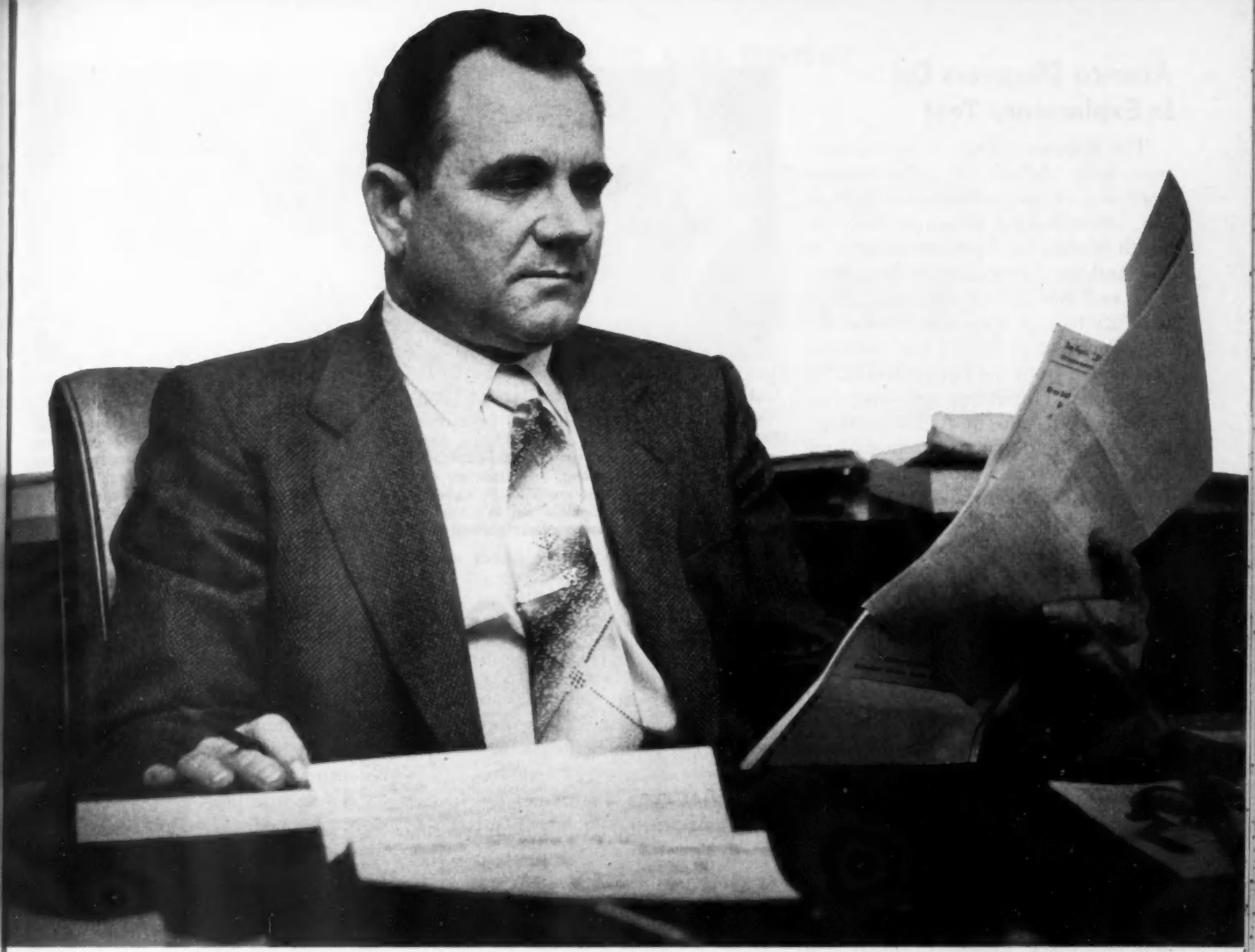
Up to the end of 1956, Imperial's expenditures for exploration and capital facilities since it discovered the Leduc field ten years ago have exceeded $800 million. The company's gross production of crude, at 44 million barrels, was up more than 10 percent from 1955. Exploratory drilling included 117 net wells in Western Canada, 46 relatively shallow holes in Ontario and one hole in the St. Lawrence lowlands of Quebec.

These wells resulted in 22 new discoveries in Western Canada (13 oil and 9 gas) and in the finding of two new Ontario gas fields. In addition, 238 successful development wells, including five gas wells, were completed in the prairie provinces and Ontario.

## Decline in Austria's Oil Output Announced

Austria's crude production during February, 1957, amounted to 1,710,576 barrels, or slightly more than 61,000 barrels daily. This amounts to a decrease of about 850 barrels per day as compared to the output in January, 1957.

Natural gas production also declined in February—to 2.6 billion cubic feet—after January output of 2.7 billion cubic feet.



Mr. William Penn, Executive Vice President
Shoreline Drilling Company, Inc.
New Orleans, La.

Shoreline Drilling Reports:

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## Aramco Discovers Oil In Exploratory Test

The discovery of oil in an exploratory well, drilled 12 miles north-northwest of the northernmost well in the 140-mile-long Ghawar field in Saudi Arabia has been announced by the Arabian American Oil Company. This well was drilled to a total depth of 7325 feet. It has been completed at a depth of 7120 feet for potential production from the D member of the Arab zone. This is the same member that is productive in Aramco's Ghawar, Abqaiq and Dammam fields, and which was recently proved productive in the Khursaniyah field.

The new well, known as 'Ain Dar Well 56, is located approximately 55 miles southwest of Dhahran, Aramco's headquarters. Further geophysical work is under way and additional drilling is planned to assist in evaluating the area.

Simultaneously Aramco announced that Khursaniyah Well 2, the first delineation well drilled since the discovery of the Khursaniyah field last year, is being completed as an observation well. Khursaniyah 2, located four miles north-northeast of the discovery well, was drilled to a total depth of 7885 feet. It defined the northern limit of the field. The various producing members, which had been oil-bearing in the discovery well, contained water.

The delineation of the Khursaniyah field, which is located approximately 80 miles northwest of Dhahran, is continuing.

### Cuban Congress Organizers Convene

**Members of the Executive and Organizing committees of the Second Cuban Congress on Petroleum, to be held in Havana, Cuba, May 5-11, are shown completing plans for the Congress. They are, left to right, R. E. Edgecombe, general manager, The Texas Company (West Indies) Ltd.; Earl Copeland, Jr., associate editor, Cuba Petroleum News Digest; Ing. Sergio J. Sanabria, Compania Petrolera Shell de Cuba, S.A.; Robert J. Macaulay, general manager, Cuban Gulf Oil Company; Francisco de la Camara, president, Salomon Oil Enterprise, S.A.; Dr. E. Lorenzo-Lucas V., formerly executive vice president of Industry Holdings, Ltd., director of the Congress.**

# a WORLD of OIL

**ALBANIA:** The current Five-Year Plan, ending in 1960, has put Albania's crude production quota for 1960 at 3.3 million barrels.

**ALGERIA.** The French Cabinet has approved in principle a pipe line from Hassi Messaoud, in southern Algeria, to the Mediterranean coast which, it is planned, will be completed by the end of 1958. . . . The first well at Hassi Messaoud encountered 459 feet of oil-saturated sandstone at about 11,000 feet.

**AUSTRIA:** Austrian Mineral Oil Administration's Suessenbrunn 3, which began producing in March at a depth of 9635-9642 feet, was yielding 135 barrels a day. . . . Wells Geretsberg 1 and Puchkirchen 2 were abandoned recently as dry holes after depths of 8358 feet and 8694 feet, respectively, were reached. . . . Equipment used at Puchkirchen 2 has been moved to drill the RAG well Muehlleiten 1.

**BULGARIA:** The 1957 crude production quota has been put at less than 2 million barrels, as compared to the approximately 1.5 million barrels reportedly produced last year. . . . Some reports have indicated that Russia may supply turbo drilling equipment to replace at least some of Bulgaria's current equipment.

**CANADA:** Imperial Oil Limited reportedly has made an important wildcat discovery at Boundary Lake, B. C., with the well yielding good quantities of oil, gas and distillate on open-hole drillstem testing.

**CZECHOSLOVAKIA:** It has been reported that all interior gas wells have been shut in as efforts are concentrated on producing gas from fields bordering Austria. To get its share of gas from common fields, Czechs are transporting their gas long distances and are saving wells in the interior for later production.

**DENMARK:** Standard Oil Company (New Jersey) was expected to begin

## Cuban Stanolind Plans Third Test Offshore, First South of Cuba

Cuban Stanolind Oil Company plans to drill its third offshore test and the first ever drilled in the waters south of Cuba. G. J. Smith, foreign exploration manager for Pan American Petroleum Corporation, parent company of Cuban Stanolind, was unable to predict the date on which the test will be spudded in since a considerable time will be required to arrange for shipment and installation of equipment.

However, according to *Cuba Petroleum News Digest,* additional offshore wells may be drilled.

The first two Stanolind wells reportedly were drilled to test two surface structures and to gain data on the nature and thickness of the sedimentary rock section. Airborne magnetic and land seismic data had indicated that thin sedimentary sections might lie on these structures, and Smith said the first two wells were drilled to determine whether this was correct.

The sections encountered in the wells confirmed the geophysical information remarkably well, according to Smith. Seismic and magnetic studies indicate that thicker sections were present in at least three directions from each of the two structures already drilled.

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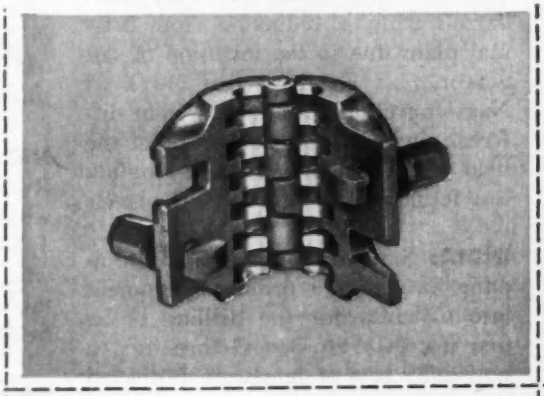

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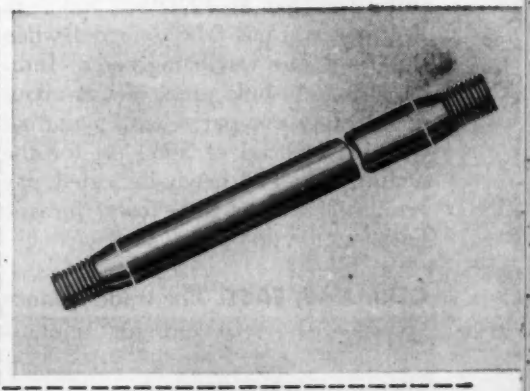

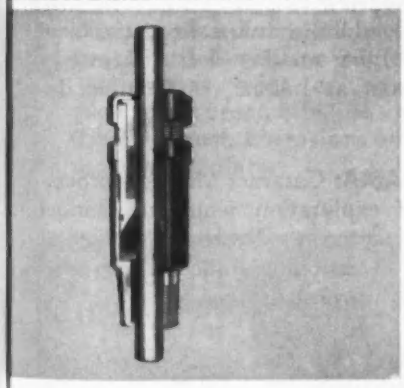

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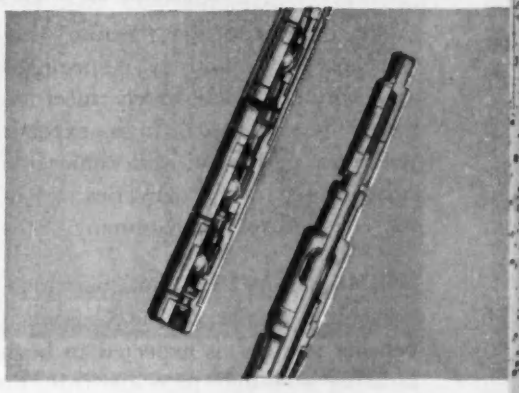

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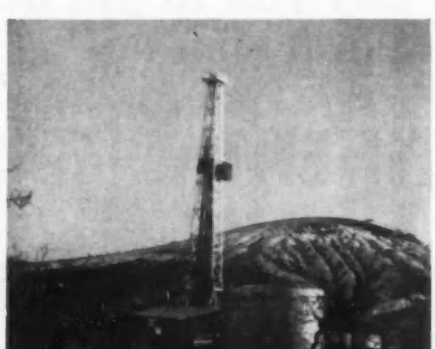
deep drilling in Jutland in August after having taken over exploration operations from Gulf Oil Corporation, which spent $10 million and ten years in an unsuccessful oil search.

**EGYPT:** Consumption in 1956 amounted to almost twice the domestic production. . . . The government is scheduled to absorb most of the oil interests in the country, with a new state controlled company, Eastern Petroleum Company, formed to act as an integrating unit with Petrofina and Azienda Generale Italiana Petroli with minority interest. Sixty-one concessions in the Red Sea zone and Eastern Desert are to be explored by the government.

**FRANCE:** Esso's deep test, Parentis 101, is reported to have encountered sulfur-free gas at 12,270-12,303 feet. A strong wet gas flow occurred when a porous zone was being cored. Indicated bottom-hole pressure was about 8500 psi, as compared with a normal hydrostatic head of 5680 psi for the depth. . . . The newly-indicated pay horizon is thought to be lower Jurassic limestone or dolomite.

**GERMANY, EAST:** The trade balance arrears with West Germany amounting to about $25 million are scheduled to be paid for with East Germany oil products. Since East Germany's oil industry is negligible and synthetic fuels barely meet domestic requirements, it is expected that part of the oil will come from Austrian reparation deliveries to Russia, rerouted to East Germany.

**GERMANY, WEST:** Gelsenkirchener Bergwerks, owner of the Gelsenberg benzine refinery, is expected to begin building a 30-mile pipe line from the refinery to the Wesel Rhine river harbor. The line apparently is intended to carry crude to the refinery and might be linked later with either a pipe line from Wilhelmshaven or from Rotterdam to the Ruhr. . . . Estimated proved crude reserves as of January 1 amounted to 365,673,000 barrels, up about 18 million barrels from the same period of the previous year. . . . The drilling industry, which recorded a footage drilled figure of 2,322,657 feet in 1956, is expected to drill 2,656,600 feet this year.



**First In Gaziantep**

**This is American Overseas Petroleum, Ltd.'s, 1 Aril, the first test on the Beyaz structure in the Gaziantep area of southeastern Turkey, which was drilling below 5600 feet in March. The contractor is Brown Drilling Company.**

**HUNGARY:** The 1957 production quota of the Nagylengyel oil field has been put at slightly less than 9200 barrels daily, a reduction from original plans due to the intrusion of salt water. . . . Exploration work at Nagylengyel is continuing at eight different sites west and northwest of the field, and a new pay in lime formation was found at 7874 feet in February.

**INDIA:** Standard-Vacuum Oil Company has shipped drilling equipment into Calcutta for the drilling of its first test in West Bengal three and a half miles east of Burdwan. Projected depth: 10,000 feet.

**IRAN:** National Iranian Oil Company was planning to expand its facilities to transmit, refine and market production from the Naft-I-Shah oil field on the Iraq border, and a new 6-inch pipe line, to parallel the current 3-inch line to the Kermanshah refinery, is expected to be built.

**IRAQ:** Legislation has been approved by the government to permit acceptance of a special Iraq Petroleum Company loan to ease financial strains caused by the sabotage of the pipe lines through Syria and resulting cutbacks in oil production.

**KUWAIT:** Gulf Oil Corporation's production and shipments from Kuwait (through 50 percent ownership of Kuwait Oil Company, Ltd.) have been greater, as of March 11, during 1957 than during the same period in any previous year, despite the Suez Canal blocking.

**LEBANON:** Trans-Arabian Pipe Line Company reported that 332,918 barrels of oil per calendar day was delivered from Sidon, Lebanon, during February, 1957, for a total of 9,321,700 barrels, as compared with 336,341 barrels per day during February, 1956, or a total of 9,753,883 barrels.

**LIBYA:** Compagnie Francaise des Petroles reportedly has received a concession from the Libyan government near the Algerian border, not far from the Edjele oil field. . . . Camdrill International, Inc., has completed two drilling contracts for exploratory tests, and is reported opening its headquarters in Tripoli.

**NETHERLANDS:** N A M has changed one rig from wildcatting to development drilling, and probably seven rigs will be used in 1957 to concentrate on drilling in the more promising of seven discoveries made in Western Holland since 1953.

**NIGERIA:** Exploration in the Niger River delta has been clarified somewhat with the completion of Oloibiri 4, which, unlike the first three wells, was a dry hole which apparently established the southern limit of the field. The fifth well was being drilled.

**PAKISTAN:** Pakistan Petroleum, Ltd., was conducting full-scale preparations for drilling another deep test in East Pakistan at Lalmai, in Comilla district.

**PANAMA:** Cataract Mining Corporation's exploration team in Chiriqui Province reportedly had identified at least 14 structures sufficiently interesting to warrant drilling.

**PERU:** The German consortium Gewerkschaft Elwerath-Deutsche Erdoel-AG-Wintershall and the Peruvian El Oriente Company have discovered oil at a depth of about 2100 feet in wildcat Maquia 1 in the jungle area east of the Andes, where exploration operations have been under way since 1954. First production test from the upper section of sugar sandstone, which at Maquia has a thickness of about 200 feet, resulted in a free flow of about 10 barrels hourly of 39 gravity oil through a $\frac{3}{16}$-inch choke.

**QATAR:** Royal Dutch Shell Group will continue drilling in the Persian

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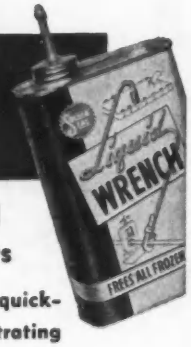


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Gulf off Qatar, despite the wrecking of its $2.5 million offshore rig by a storm in December.

**RUMANIA:** An unspecified number of declining oil producers in the Boldesti field have been included in an extended proposed secondary recovery program.

**RUSSIA:** Four new wells have been completed as producers in the new pay zone of the Ozek-Suat field south of Stavropol City. . . . The initial 15 miles of the second Stavropol-Moscow gas pipe line have been completed.

**SAUDI ARABIA:** Crude production averaged 665,204 barrels daily during January, for a total for the month of 20,621,338 barrels, representing a steep drop from January, 1956, when an average of 1,000,239 barrels daily amounted to a monthly total of 31,007,394 barrels.

**SOMALIA:** Sinclair Somal Corporation abandoned Gira 1, located 27 miles west of Obbia at 12,764 feet because of mechanical difficulties. While no shows of oil were reported, a second test—Obbia 1—was scheduled for spudding near the Indian Ocean coast 40 miles northeast of Gira 1. . . . Two seismic and two field geological crews were at work in late February on Sinclair Somal's concession.

**SWITZERLAND:** Schweizer Erdoel A. G. recently was founded in Zurich to develop the nation's oil potential, and as successor to the Swiss Oil Concordate, SEAG is operating at the canonal areas of St. Gallen, Thurgau, Aargau and Zurich.

**SYRIA:** Trans-Arabian Pipe Line Company and the government were reported to have renewed negotiations March 4 in Damascus concerning a raise in payments by the company from the current $1.2 million annually paid. . . . The government gave its approval for repairs to the sabotaged Iraq Petroleum Company crude lines from Iraq to the Mediterranean, and after by-passes around the blasted pump stations were constructed, the lines were expected to begin delivering from 200,000 to 250,000 barrels daily to the Mediterranean. Full rehabilitation of the system to capacity of about 560,000 barrels daily was not expected to be possible until early 1958.


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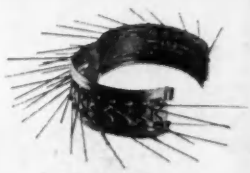

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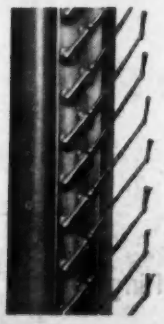

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# DRILLING HINTS

**These How-To-Do-It Ideas Can Save You Money**

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## Stop Swinging of Blocks When Running Casing

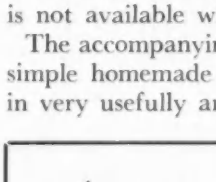
To make the job of stabbing casing easier, one operator has devised a very simple trick that can be rigged up in very short order and will prevent the blocks from swinging. A ⅝-inch line is strung from the water table, or crown block, to a turnbuckle, in front of the drawworks. This line is stretched taut by use of the turnbuckle. A regular hay pulley on the tight line with a short line running to the top of the blocks is all the equipment that is needed. The short line from the hay pulley to the top of the blocks is adjusted so that the blocks can run up and down the derrick straight; but will prevent the blocks from swinging any considerable distance from center. This makes stabbing of casing joints easier and also faster because there is little or no swing in the blocks.

As soon as the casing is run, the line can be slacked off at the turnbuckle and easily tied back or removed from the derrick entirely.

## Emergency Hose Clamp Made With Wire, Bolt

Around the power rig there are many different kinds of hose connections, some large and some small. Many times extra hose clamps are not kept on a rig. This can be quite time consuming and inconvenient when the necessary size hose clamp is not available when rigging up.

The accompanying drawing shows a simple homemade clamp that comes in very usefully around a power rig.



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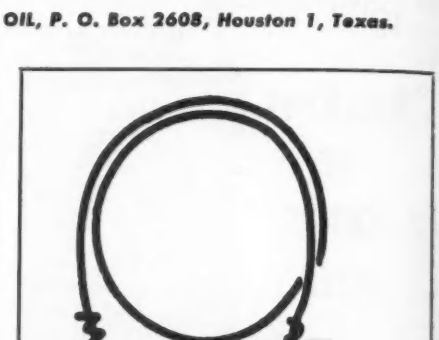
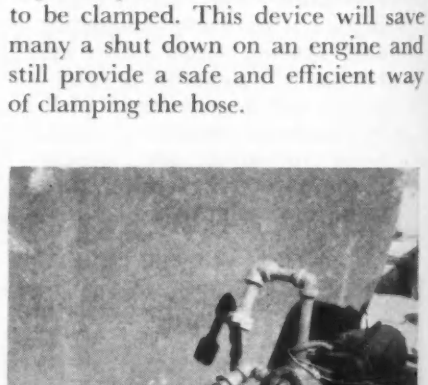


It is made from light wire and a nut and bolt. It can be wrapped to any needed size and will suffice until a regular clamp can be obtained.

The size of the bolt and wire will depend upon the size of hose that is to be clamped. This device will save many a shut down on an engine and still provide a safe and efficient way of clamping the hose.



## Mount Rotary Motor On Fuel Tank Base

Where the fuel tank is set on the ground rather than up on stilts or a stand, it is conceivable that at times the pressure head in the fuel lines would be quite low. To offset this disadvantage and to have the convenience of a skid-mounted tank

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## Mud Pump Relief Valve Importance Becomes More Critical

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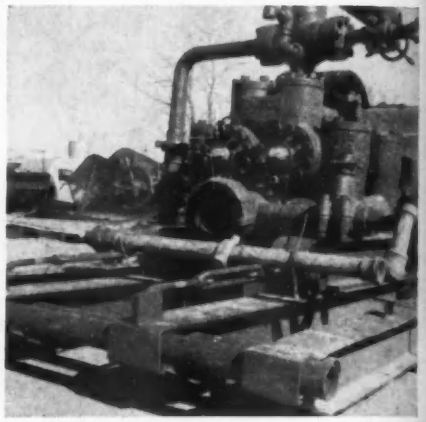
that is easy to suck up onto a truck, one Gulf Coast operator has mounted an electric motor driven rotary pump on a small bracket mounted on the fuel tank skid base.

This arrangement provides a pressure head of a few pounds in the fuel system at all times, thus keeping the lines full and the engines running smoothly. It is located in a convenient and out-of-the-way place, and the motor is run from the rig light plant.



## Time-Saving Turnbuckle Helps Tighten Pump Belts

One Gulf Coast contractor has found a very convenient means of tightening, or taking up the slack in his pump belts when rigging up. The large pump skid is extended in front of the fluid end of the pump far enough so that a large turnbuckle can be welded in place. One end of the turnbuckle is welded to the pump frame and the other end to a bracket that is welded to the front end of the pump skid. By loosening the bolts that hold the pump frame to the skid base, these turnbuckles can be used to move the pump forward or backward so that the belts can be slipped on and then the slack taken up.

In the above photo, although the pump is dismantled for moving, the turnbuckles can be noticed just forward of the suction line connection.

This feature enables the slack to be taken up in the belts and a little closer alignment can also be made without the use of a truck. It is time saving and convenient and when necessary the slack can be taken up during operation which normally

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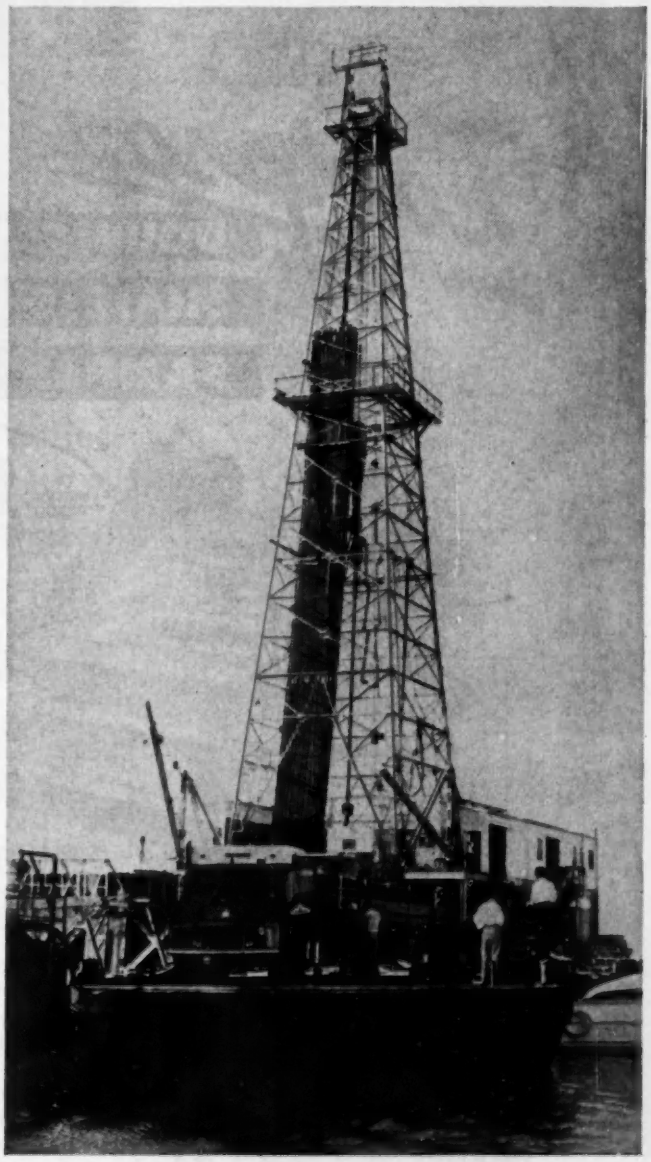

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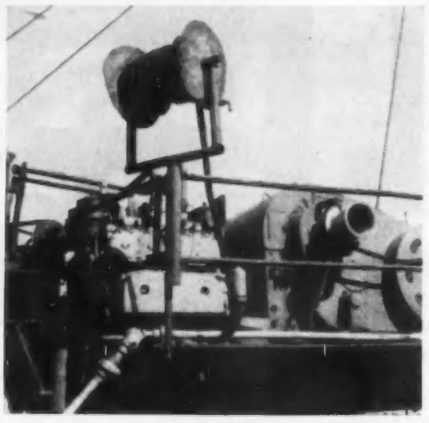
would be a job entailing a winch truck or hydraulic jacks to move the pump base.



## Spool Catline off Floor For Neatness and Safety

On a small rig it is often difficult to provide adequate storage for tools, parts etc. In the interest of safety, however, some method should be provided for getting the catline off the rig floor. Hooks, rocks, spools and other devices are often used.

One contractor with a small, truck mounted rig solved this problem very ably with a small shopmade spool. He welded a short piece of 3-inch pipe to the corner of the guard rail as illustrated in the photograph. He then made a spool frame of 2-inch pipe and a spool of sheet metal and a piece of 2½-inch pipe. When the spool was assembled, it was an easy matter to stab the reel into its holder and be ready for business.

The holes in the guide at the edge of the spool are made for a small stop that hits the pipe frame and keeps the spool from unraveling the line prematurely.

With this device the catline can be kept off the rig floor at all times when it is not in use. It not only makes the rig look neat but helps make it a safer place to work.

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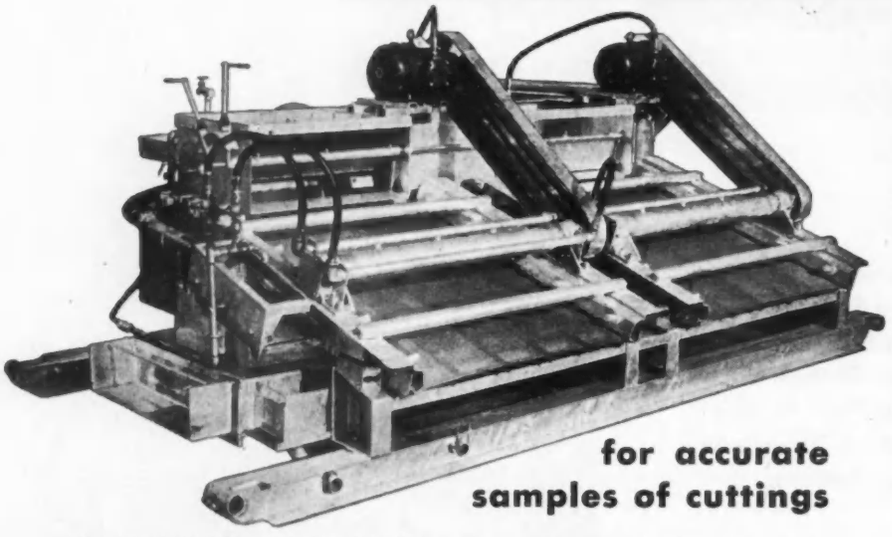

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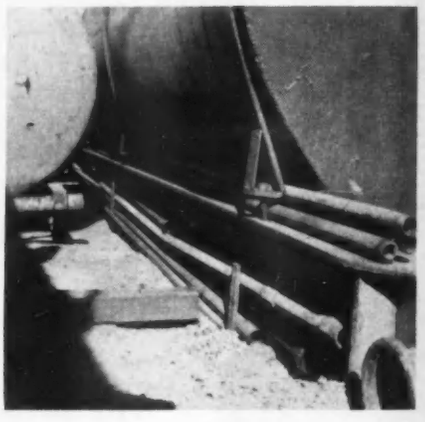

## Carry Pipe on Skid Base For Water, Fuel Hook-Up

One of the major problems when moving a rig is to have the pipe and connections available where and when they are needed to hook up water and fuel lines. As these are usually carried in separate loads from the fuel and water tanks, it sometimes presents quite a problem in logistics.

One Gulf Coast operator has solved this problem to a certain degree by adapting his skids to carry his inch, and 1½-inch pipe for his fuel lines. The skid base is made out of "I" beams and on the outside of each I-beam a piece of metal stock about 8 inches long is welded to the bottom of the I-beam making a rack as shown in the enclosed figure where the pipe can be carried.

Also the space between the strap clamp and the tank provides a handy recess where additional pipe can be



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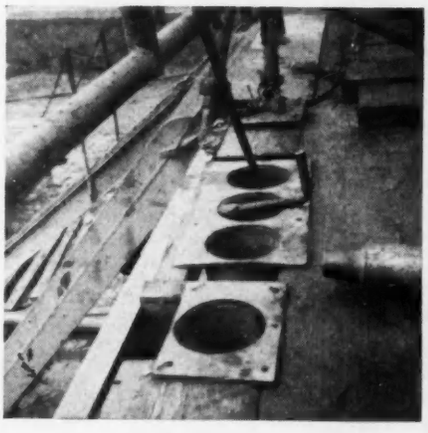
racked for moving. This feature lends itself very well to rigging up in that the moment the fuel tank is spotted the crew can start laying the fuel lines with the pipe and even some of the connections readily available.

This feature not only lends to the convenience in rigging up, but it also saves time and space on the moves.



## Sumps Made From Casing Provide Drill Tool Rack

Most drilling rigs have an accumulation of change over subs, reamer bodies, and stabilizer bodies that are sometimes hard to store or rack and could be quite a safety hazard if left lying around.

One operator solved this problem by fabricating a number of sumps to handle this type of material. A piece of plate metal had circular holes cut in it to fit a certain size casing, in this case a 7-inch. A short length of casing anywhere from 18 inches to 3 feet was cut and welded to the bottom of the plate and the circular piece that was cut out of the plate metal was welded to the bottom of the casing forming a sump. Suitable holes were burnt in this bottom plate so that water would not accumulate in the sumps. In this manner various subs and drill string tools mentioned above, as well as odds and ends of rig tools, etc., were racked and out of the way.

This is a safe and convenient manner of handling these tools and does not leave them lying around where their threaded connections can become damaged and provide a hazard to working on the rig floor.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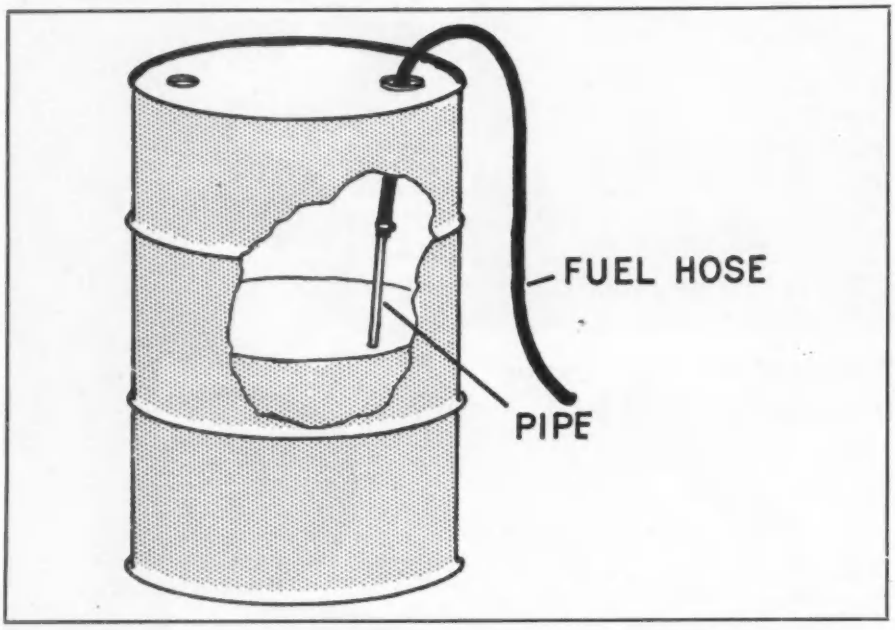
THE ORIGINAL COMPOSITION CUP

# PRODUCTION HINTS

**These How-To-Do-It Ideas Can Save You Money**

***$10 is paid for each illustrated acceptable contribution. Mail to The Editor, WORLD OIL, P. O. Box 2608, Houston 1, Texas.***



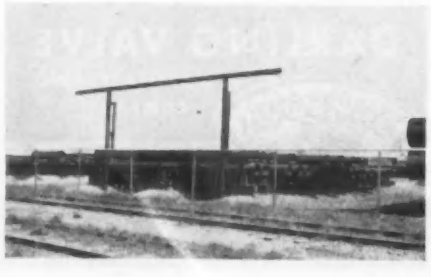

## A Short Pipe Prevents Hose Wicking

Even the best grade of rubber hose will deteriorate rapidly if hydrocarbons are allowed to wick up the fiber jacket. There are, however, several good ways to eliminate this problem.

One way is to insert a short piece of metal pipe into the rubber hose before placing it in a gasoline drum. The pipe comes in contact with the gasoline instead of the hose which prevents hose failure resulting from the fluid attacking the fibers. Capillary action or wicking can cause deterioration for a considerable distance from the immersed end of a hose.

A second protection method involves the use of a film of liquid neoprene rubber compound. This compound, applied to hose used for filling fuel or lube tanks, will dry into a durable film and prevent the fluid from entering the hose fibers.

If protection is desired for a hose used only in water, a coating of shellac will serve to protect the fibers.



## Retain Stacked Pipe With Welded Frame

The company whose pipe racks ran parallel to the rail line shown in the illustration had a major responsibility in retaining the large diameter pipe stored on these racks. Space restriction often required the pipe to be stacked fairly high. To keep the pipe from rolling onto the rails they built a retainer frame.

The construction of this welded frame is adequately illustrated in the photograph. Dimensions would be dependent upon characteristics of the individual situation—pipe diameter, and length, how high it was to be stacked, etc.

The cables supporting the top of the frame reduce the flexibility of the legs of the frame. They keep the frame from bending when lateral pressure is applied by the pipe at the top of the stack. When the top layers are rolled into place, there is considerable force applied to the frame each time the rolling pipe hits the one before it.

The cables are attached to a length of pipe similar to that used as the horizontal member of the frame. It is held in place by the legs of the pipe rack to which it is bolted.

To date, this system has proved highly succesful.

## Store Conductor Cable On a Portable Spool

Occasionally sand lines or conductor cable is strung on the ground when a change has to be made in a hurry. Later this cable must be

# Here . . . the wet-dry corrosion zone gets time-proved protection at lower cost

Magnolia Petroleum Company engineers did a lot of careful investigation before they selected the material for the wet-dry corrosion zone in the Company's Central Separator platforms located near Eugene Island, Louisiana. They were well aware of the severe service life threats and so material durability was all-important. But material *economy* was essential, too. In other words, for the particular application where serviceability as well as corrosion protection are essential, they wanted a material that would provide lowest-cost-per-year of service.

They found, after thorough reviews of material cost and performance in salt water services, that wrought iron answered their requirements. Nearly 269 tons of wrought iron pipe and plate were used for dolphin hoods, boat landing supports, bracing for dolphins and pile clusters, and bumper strips for landing docks.

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picked up and moved. A simple way of handling this task is shown in the attached photo.

A spool is made, dragged behind a car or truck and the cable is easily rolled up on the drum.

To make the spool, get a couple of automobile wheels. Cut a piece of 6-inch diameter pipe to whatever length you desire and buy or make four or five bolts an inch or so longer than the pipe. To assemble the unit insert the bolts in the stud hole of one wheel, running them through the 6-inch pipe and the second wheel and secure them with the nuts. A 1-inch hole drilled in the 6-inch pipe provides a starting place for the cable.

As illustrated, the axle for the spool is a length of 1-inch pipe tied to a rope bridle. When it comes time to remove the cable from the drum, the 1-inch shaft can be placed on blocks and the line unspooled easily.

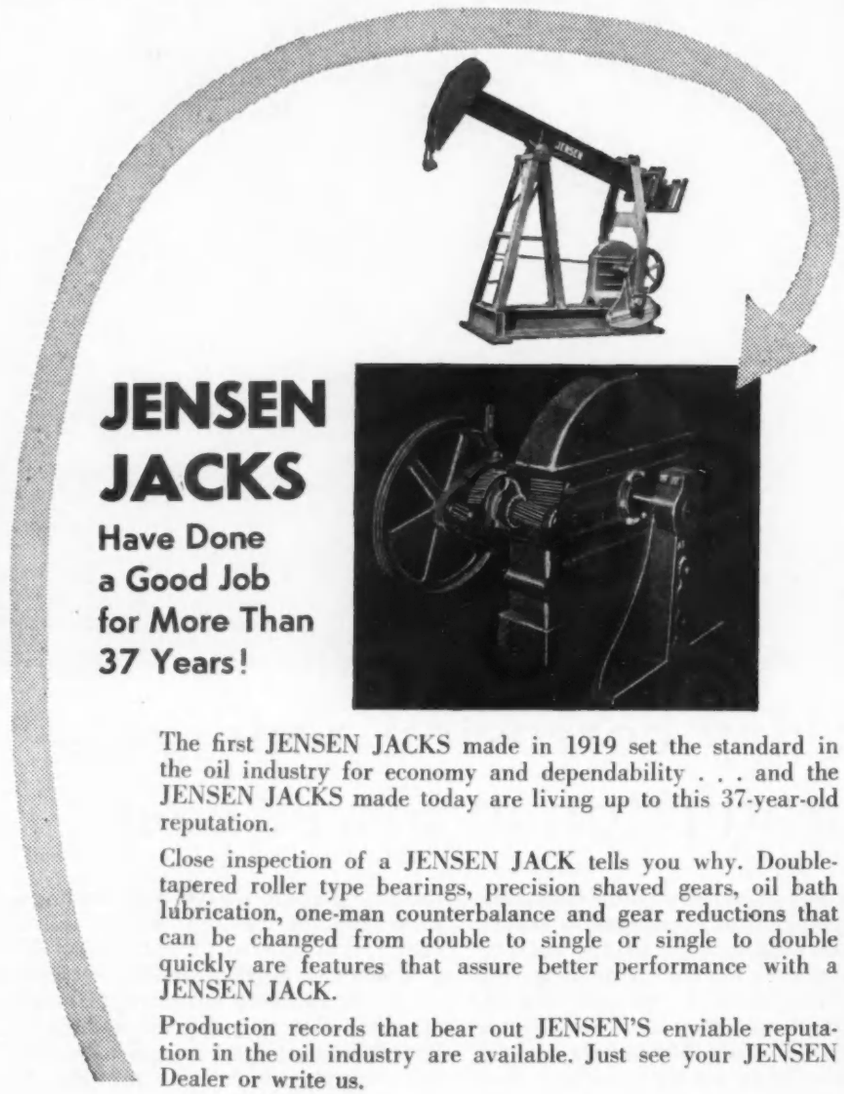
## Confine Fire on Catwalk With Perforated Firebreak

A vast majority of the catwalks around wellheads and tank batteries on water locations are made of creosoted planks and pilings. If, through some mishap, a fire should occur, these catwalks would tend to help the fire spread.

One company found a solution to this situation by making a firebreak in all their catwalks. Make the firebreak from a piece of perforated sheet steel, the type commonly used for a tank battery "run around." Bolting these metal sections in place in the catwalks provides a break in the combustible material and prevents the fire from continuing on its course.

## Gathering Line Holds Catwalk Over Low Field

Excessive rain in some areas along the Gulf leaves the ground so soggy that travel on foot is almost impossible. It is not unusual at such times to see a pumper tight-rope-walking

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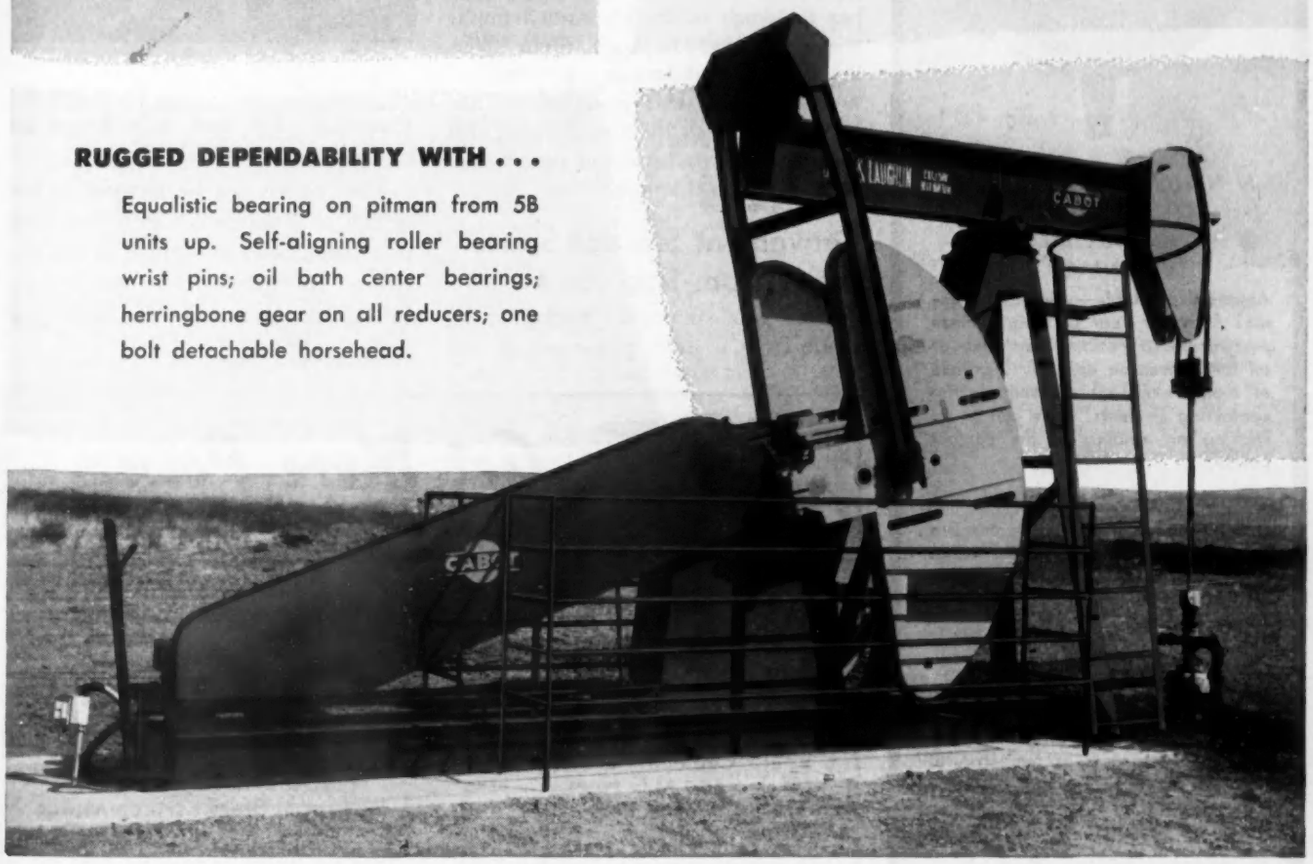


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**WRITE FOR BULLETIN 4B**

**THE MERCOID CORPORATION**
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along gathering lines to a storage location.

One company decided to take advantage of an exposed gathering line over a particularly low field and build a walk on it. They cut ¼-inch by 2-inch steel strips into 1-foot lengths and burned an arc in each piece to fit the line. These strips were tack welded at about 6-foot intervals to the line and 1" x 1" angles were welded to them as shown in the photograph. Heavy expanded metal was cut to fit between the angles and with it in place the catwalk was complete. The job can be made even more satisfactory by wiring the ends of the expanded metal strips together to keep them from bending up and forming a hazard.

A walk like this provides an all-weather route to their equipment and eliminates the necessity of people trying to walk on the pipe.

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Here is a convenient storage space made from a short pup-joint. It will help keep welding rod or perishable materials dry and safe from the rigors of oil field activity.

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# What's Happening

## AMONG MEN IN THE INDUSTRY

**K. W. Kendrick** was elected regional vice president of **Standard Oil Company of California, Western Operations, Inc.,** for southern California. He will continue as Los Angeles regional manager of wholesale sales. As regional vice president, Kendrick will direct activities in the fields of stockholder, community and industry relations. Kendrick joined Standard in 1919. He became Los Angeles district manager in 1943 and regional wholesale manager in 1954. Before moving to Los Angeles, he directed Standard's district marketing organizations in Medford, Ore.; Fresno and Sacramento, Calif.

K. W. Kendrick

•

**Dixilyn Drilling Corporation,** Odessa, Texas, announced the election of four new directors to the company's board. They are **Dr. K. C. Heald, Benjamin L. Bird, R. O. Canon** and **Blancke Noyes.** Dr. Heald, a petroleum consultant, was with Gulf Oil Corporation from 1925 to 1953, serving as staff geologist, vice president and a member of the board of directors; previously, he was chief, of the Oil and Gas section, U. S. Geological Survey and taught at the John Hopkins University, University of Chicago and Yale University. Bird, an attorney, is a partner in the law firm of Weeks, Bird, Canon, and Appleman; vice president, secretary and member of the board of directors of V. Robert Kerr & Company; president and director of Forty Oaks Center, Inc., and chairman of the board of B. O. Bracey and Company. Canon, an independent oil operator, is president of Oil Center Broadcasting Company, director of the American Bank of Commerce, secretary and treasurer of Kimball Gas Products Company, and past president and director of Petroleum Marketers Association of Texas. Noyes is a partner in the investment and banking firm of Hemphill, Noyes & Co. and is a director of Calvin Consolidated Oil and Gas Co., Limited.

•

**Dr. W. A. Gorman** has resigned as vice president of Drilling & Exploration Co., Inc., to accept a position as manager of exploration for **Royal Oil & Gas Corp.** Gorman has been in the oil business in Houston for the past 20 years.

•

**E. O. Bennett,** petroleum consultant, announces his retirement from active duty as senior partner with the firm of Petroleum Consultants of Houston, Texas, and Denver, Colorado. He is being retained by the firm in an advisory consulting capacity. To continue with some special domestic and foreign consulting assignments in the petroleum and natural gas industries in which he has completed 40 years of service and also to look after his personal interests, he will maintain offices in Houston.

•

**George B. Jenkinson** has opened an office in the Pan American building in Tulsa as an independent oil operator and consultant. Jenkinson recently retired from Pan American Petroleum Corp. after more than 42 years' service with the company and its affiliates. He was unitization manager at the time. In his new venture, he will specialize in the development of petroleum reserves, unitization of Federal exploratory and fieldwide producing units, and the purchase and sale of state, Federal and patented leases, royalties and proven properties. Jenkinson began his oil industry career in 1914 as a roustabout with Midwest Refining Company in the Salt Creek field, Wyoming. He was with Midwest until 1932, serving in the Rocky Mountain area in capacities ranging from field clerk and field superintendent through exploration drilling superintendent at Denver and production superintendent at Shiprock, N. M. When Pan American (then Stanolind Oil and Gas Company) acquired Midwest's field properties in 1932, Jenkinson was manager of the Land department of Midwest at Denver. He became division landman for Pan American, serving in both Denver and Casper, Wyo. He moved to Tulsa in 1933, becoming assistant manager of the Land department in Pan American's general office. He moved up to manager in 1941, retaining the post until 1948 when he was named assistant manager of foreign exploration. He assumed the title of unitization manager in 1950.

•

**L. E. Davis** has been appointed general superintendent of operations and construction and **M. I. McGowan** has been named chief engineer of the **Marine Gathering Company,** a wholly-owned subsidiary of Commonwealth Oil Company of Houston. Davis will have his headquarters in Beaumont. Before joining Marine Gathering in 1954, he was connected with the McCarthy Chemical Corp. and its successor, the Texas Gas Corporation for eight years as instrument supervisor at the Winnie, Texas, plant. Previously he had done instrument and measurement work for Pure Oil Company for 13 years and Humble Oil & Refining Company for three years. McGowan was associated with Tellepsen Petro-Chem Constructors before joining Marine Gathering in July, 1956. Before that he had been assistant chief engineer for Mathieson Chemical Company, chief engineer for McCarthy Chemical Corp. and assistant chief engineer for Dow Chemical Company at Freeport, Texas, during World War II.

•

**Dr. George F. Kirby, Jr.,** has been elected a director of **Ethyl Corporation.** Dr. Kirby who is vice president in charge of research and development for the company, has been associated with Ethyl since 1940.

George J. Gregor

R. G. Sanders

Charles B. Wallace

L. H. True

**Magnolia Petroleum Company's** board of directors added four new members. The four are **George J. Gregor,** who also becomes vice president in charge of marketing; **R. G. Sanders,** also named vice president and manager of refining; **Charles B. Wallace,** who also becomes a vice president in addition to his present duties as general counsel; and **L. H. True.** Gregor will succeed **Guy L. Tate,** vice president in charge of marketing, who retired. Gregor joined Socony Mobil Oil Company, Inc., in 1922. He progressed through positions of bookkeeper, credit clerk, district credit manager, general salesman and manager of the Buffalo, N. Y., Marketing district before being named manager of the Lakes division 14 years ago. He was transferred to Magnolia, Socony Mobil's southwestern affiliate in 1956 as assistant to Tate. Succeeding **John W. Newton,** who retired May 1 as vice president and manager of refining, will be Sanders, an assistant manager of the Refining division since 1938. Sanders started work with Magnolia in 1920. He became chief engineer of the Refining division in 1928, and then executive assistant in 1936. Wallace joined Magnolia's legal staff in 1939 and was named general counsel on July 1, 1956. Also taking a directorship of the petroleum company is L. H. True, who has served as president of Magnolia Pipe Line Company since 1952. True joined the company in 1921. He was promoted through various positions, being named assistant manager of pipe lines in 1938. He was elected a director of Magnolia Pipe Line in 1945, and in the same year was named vice president. In 1946 he was appointed manager of pipe lines, a position that preceded his presidency of the company. Magnolia Petroleum also announced the appointment of two assistant vice presidents: **M. W. Patterson** and **E. J. Wacker, Jr.** Patterson has served as treas-

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urer of the company since 1946. Wacker has been vice president of Magnolia Pipe Line Company since 1955. In addition, **Fred H. Pennington** of Dallas was elected treasurer of Magnolia. Pennington has been supervisor of tax and governmental reports since 1950.

•

**E. I. Grizzell** has been promoted to the job of supervisor of the **Independent Exploration Company.**

E. I. Grizzell

Prior to his advancement to the supervisor position, Grizzell served in the technical jobs of surveyor, observer, computer and party chief. In this new work, he will be responsible for the interpretation of seismic data, and the overall operations of field crews are under his direction. Grizzell has been with Independent Exploration Company for 20 years. Eight years of this time were in Independent Exploration's foreign operations in the Middle East, South America and the West Indies. He has been in the oil exploration business for 22 years.

•

**R. R. Robison** has been named manager of the newly-formed Farmington Production division of **Shell Oil Company's** Pacific Coast Exploration and Production area. Shell's Farmington Production division is slated to be divided into two districts. The San Juan district will cover the company's production activities in northwestern New Mexico, and the Paradox Basin district will be responsible for southeastern Utah operations. Prior to his new position, Robison served as manager of Shell's San Joaquin Production division in California. In this area, he was responsible for the direction of production operations in the San Joaquin-Sacramento Valley chain, running almost the length of the state. Before assuming his duties there in 1952, he was production superintendent of Shell's Coastal division, with headquarters at Ventura, Calif. Robison joined Shell in 1924. His first assignment was that of field engineer in Long Beach, Calif. No stranger to the Rocky Mountain region, his career has taken him to Shell oil fields in Wyoming and Alberta, Canada.

•

**Neil S. Whitmore** has succeeded **Robert B. LeFever** as district superintendent for **Pan American Petroleum Corporation** at Lubbock, Texas. LeFever has been transferred to Calgary, Alberta, Canada, to become assistant division production superintendent. Whitmore moves to Lubbock from Midland, Texas, where he had served as assistant district superintendent since 1953. Whitmore joined Pan American (then Stanolind Oil and Gas Company) in 1946. He was field project engineer at Sundown, Texas, in 1948 during construction of the Slaughter gasoline plant, operated by Pan American for a group of owners, and served as assistant superintendent of the plant for two years after its completion. In 1951, he was transferred to Andrews, Texas, as superintendent of the South Fullerton gasoline plant, also operated by Pan American for a


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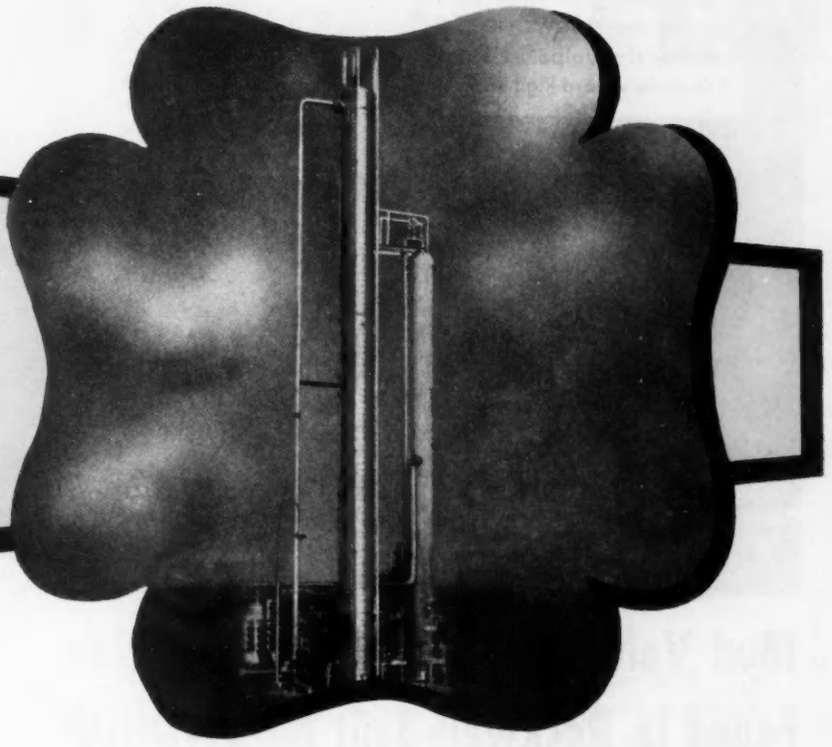

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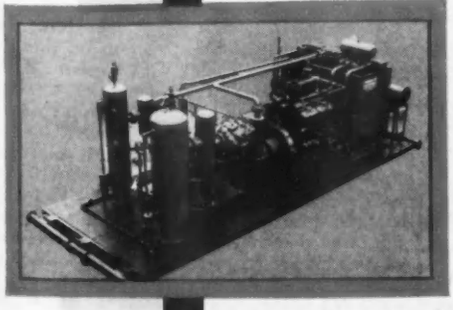

The McNamar Joy WNB 112, 200 horsepower, twin cylinder Gas Compressor features compactness, portability and versatility. The units are completely packaged, easily installed and economical to operate.

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# Tips on Mud Valves for Toolpushers . .

Zack Taylor (right) and Toolpusher Jim Wilkson discuss the MUDWONDER on the standpipe of the Falcon-Seaboard Rig No. 9.

## Mud Valve Economy, Easy Operation Found In Rockwell-Built MUDWONDER

**by Zack Taylor, Division Manager**
**Falcon-Seaboard Drilling Company, Denver, Colorado**

ECONOMY . . . Easy operation . . . Have you searched in vain for mud valves that would give you these benefits? We did until our experience with Rockwell-Built *Mudwonders*. Now, we use them on standpipes, mudlines, mud tanks, blowout preventers, etc. Eight months of testing and using *Mudwonders* proved to us that they are superior to any mud valve we have ever used, regardless of application.

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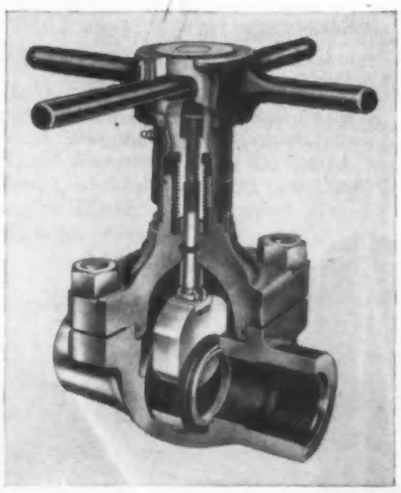
**MUDWONDER cut-away view shows the double thread construction, separated stainless stem and hard chromed gate with "T" slot connection and the one-piece seat insert with the buna-N molded integrally over the steel wear rings.**



Advertisement

John D. Gauntt, Jr.

group of owners. Whitmore moved from the South Fullerton plant to the Midland district office as assistant superintendent in July, 1953.

•

**Trunkline Gas Company** of Houston has announced the opening of a production and supply field office in Corpus Christi, Texas, and the appointment of **John D. Gauntt, Jr.**, as district geologist for the Corpus Christi area. Gauntt joined Trunkline Gas from Skelly Oil Company where he was assistant Corpus Christi district geologist. He was with the firm for five years. Gauntt worked for Lone Star Gas Company of Dallas for three years as a geologist before joining Skelly.

•

**R. A. Bishop,** Northwest division geologist, was transferred to Oklahoma City headquarters as staff assistant—exploration for **Sohio Petroleum Company,** Production department. He will report to **R. W. Edmund. A. C. Munyan,** staff geologist in the Northwest division, replaces Bishop as division geologist.

•

**Ted L. Bear,** consultant, and **Phillip S. Kistler,** formerly principal representative for DeGolyer and MacNaughton Incorporated in Brazil and Spain, have opened a consulting office in Los Angeles.

•

**Ball Associates,** oil and gas consultants, announces the affiliation of **Peter G. Burnett** and **J. Norval Jackson** as associates. Burnett was formerly with Stanolind Oil and Gas Company and Jackson was previously with Creole Petroleum Corporation in Venezuela. Ball Associates has offices in Washington, D. C., and Denver.

•

**Dr. H. C. G. Knipscheer** has joined the Calgary, Alberta, office of **Alex McCoy Associates, Inc.,** Tulsa geological consulting firm, as a geologist. The Calgary office will maintain a separate section to offer additional service to the Tulsa office.

•

**The Texas Company** has announced the appointment of **Dr. Gerhard Herzog** as an assistant general manager of the Research and Technical department. **B. D. Lee** was appointed manager of exploration research, and **K. C. ten Brink** as manager of production research. Concurrent with these appointments, Exploration and Production Research was established as a division in the company's Research and Technical department. It also was announced that **J. C. Allen** now is director of production research and **A. S. McKay** is director of exploration research.

•

**Howard R. Ritzma** has opened offices as a consulting geologist in Denver. His office is at 2515 South Lowell Boulevard for the present time. Ritzma was formerly employed as Rocky Mountain district geologist for Southern California Petro-

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## Rugged - Dependable - Years Ahead

### the NEW ALTEN "Mustang" A-3F-D6

Small but powerful, like the hardy Mustang of the prairies, the Alten D-6 "Mustang" is an all new unit designed especially for low-cost, long-term operation of waterflood projects and shallow wells. The "Mustang" is another indication of Alten leadership in pumping unit design. Ever since the first pumping units were built for early Pennsylvania fields, the Alten line has been continually improved and expanded. This great new unit is the recent result of Alten experience and advanced engineering technique.

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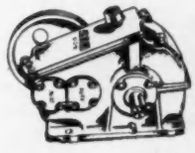
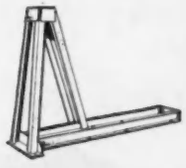


Completely new, engineered exclusively for this miles-ahead D-6 unit. Lower tooth pressures and longer life are provided by the extra width gear faces. New low-level oiling system is made positive by Alten's unique oil wipers. Double-ribbed reducer housing . . . oversized tapered roller bearings.

### NEW FRAME



Frame and samson post assembly are all new, the most rugged frame on any small unit. Four legged heavy samson post designed to handle maximum loads with ease.

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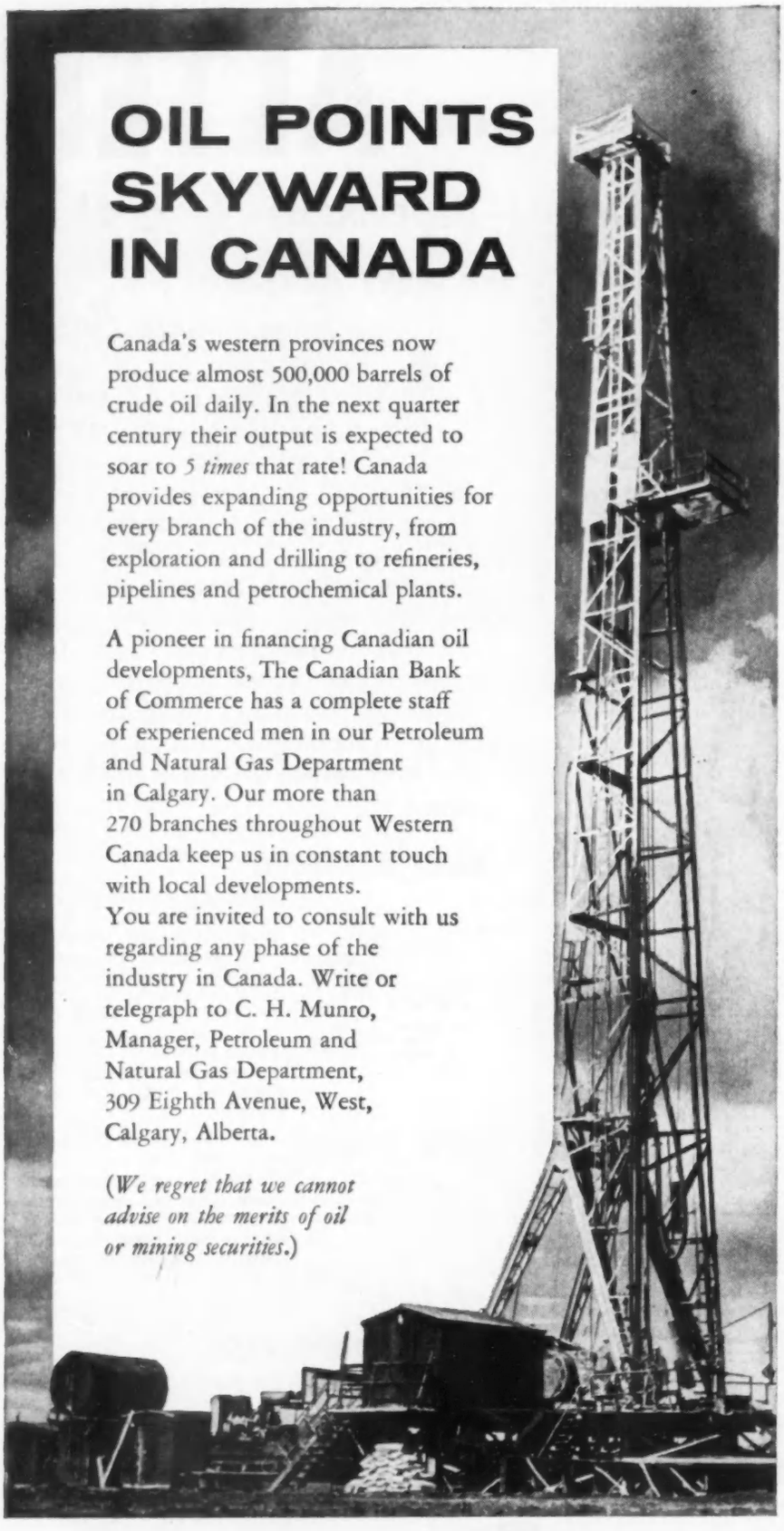
You are invited to consult with us regarding any phase of the industry in Canada. Write or telegraph to C. H. Munro, Manager, Petroleum and Natural Gas Department, 309 Eighth Avenue, West, Calgary, Alberta.

(*We regret that we cannot advise on the merits of oil or mining securities.*)



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leum Corporation in Denver. He plans to conduct general geological service throughout the Rocky Mountain region specializing in the Three Corners area, northwest Colorado, northeast Utah and southwest Wyoming.

•

**S. H. Lloyd** has recently been appointed manager of **Blue Water Drilling Corporation,** recently organized offshore drilling company. Prior to joining Blue Water Drilling Corporation, Lloyd was chief engineer of Salt Dome Production Company where he had been actively engaged in the offshore drilling operations of the firm since 1947. He will be in charge of operations for Blue Water Corporation, which recently awarded a contract to Ingalls Shipbuilding Company, Pascagoula, Miss., of an offshore drilling barge which will be ready to engage in offshore drilling by August 1, 1957. Temporary offices of the Blue Water Drilling Corporation will be located at 208 Maritime building, New Orleans.

S. H. Lloyd

•

**Robert S. Haigh** has been promoted to district geologist of the Bismarck (N. D.) Production and Exploration district of **Lion Oil Company,** a Division of Monsanto Chemical Company. Haigh has been a geologist in the Billings, Mont., district since he joined Lion in 1954. He replaces **Ray L. Harrison, Jr.,** who recently resigned.

•

**Dr. Victor Oppenheim** and **Glenn O. Briscoe** have opened offices in Suite 1206, Mercantile Securities Building, Dallas, as consultants in petroleum and mineral explorations in the Mid-Continent area and in Central and South America.

•

**A. W. Black** has been promoted to regional geophysicist for **Continental Oil Company's** Rocky Mountain region. Formerly assistant regional geophysicist, he will continue to make his headquarters in Denver and will succeed **C. B. Smith, Jr.,** who recently was promoted to Rocky Mountain region exploration manager.

•

**Basil P. Kantzer** and **Charles S. Parker** were elected vice presidents of **Union Oil Company of California.** Kantzer is manager of operations for Union's Gulf division, with headquarters in Houston. He joined Union Oil in 1934 as a rigman. Parker is director of economics and planning, with headquarters in Los Angeles. He joined Union Oil in 1932 as a laboratory technician.

•

**L. C. Lindeblad** who has been a staff geologist for the past 14 years with **Pan American Petroleum Corporation** (formerly Stanolind Oil and Gas Company) has opened an office as a consulting geologist in Roswell, N. M. Lindeblad was first employed by the company as a surface geol-

ogist but during the last 12 years was employed as a subsurface geologist. Prior to joining Pan American, Lindeblad had been employed as a geologist with the ITIO and Cities Service Oil Companies.

•

**John T. Snyder, Jr.**, has been elected financial vice president of **Pan American Petroleum Corporation.** He will also serve on the Pan American board of directors. He has been financial vice president, secretary and director of the Southern Production Company, Inc., Fort Worth, Texas, for the past five years. Prior to that time, he was a partner in the New York firm of Ingalls and Snyder, investment brokers.

John T. Snyder, Jr.

•

**Jack A. Taylor** has been transferred from **Magnolia Petroleum Company's** Geological department's subdistrict in Lake Charles, La., to Mount Vernon, Ill., where he is now district geologist in charge of the Illinois district.

•

**Gibson Petroleum Co., Ltd.,** has announced the appointments of **W. H. Green** as president and **H. L. Shockley** as vice president and managing director.

•

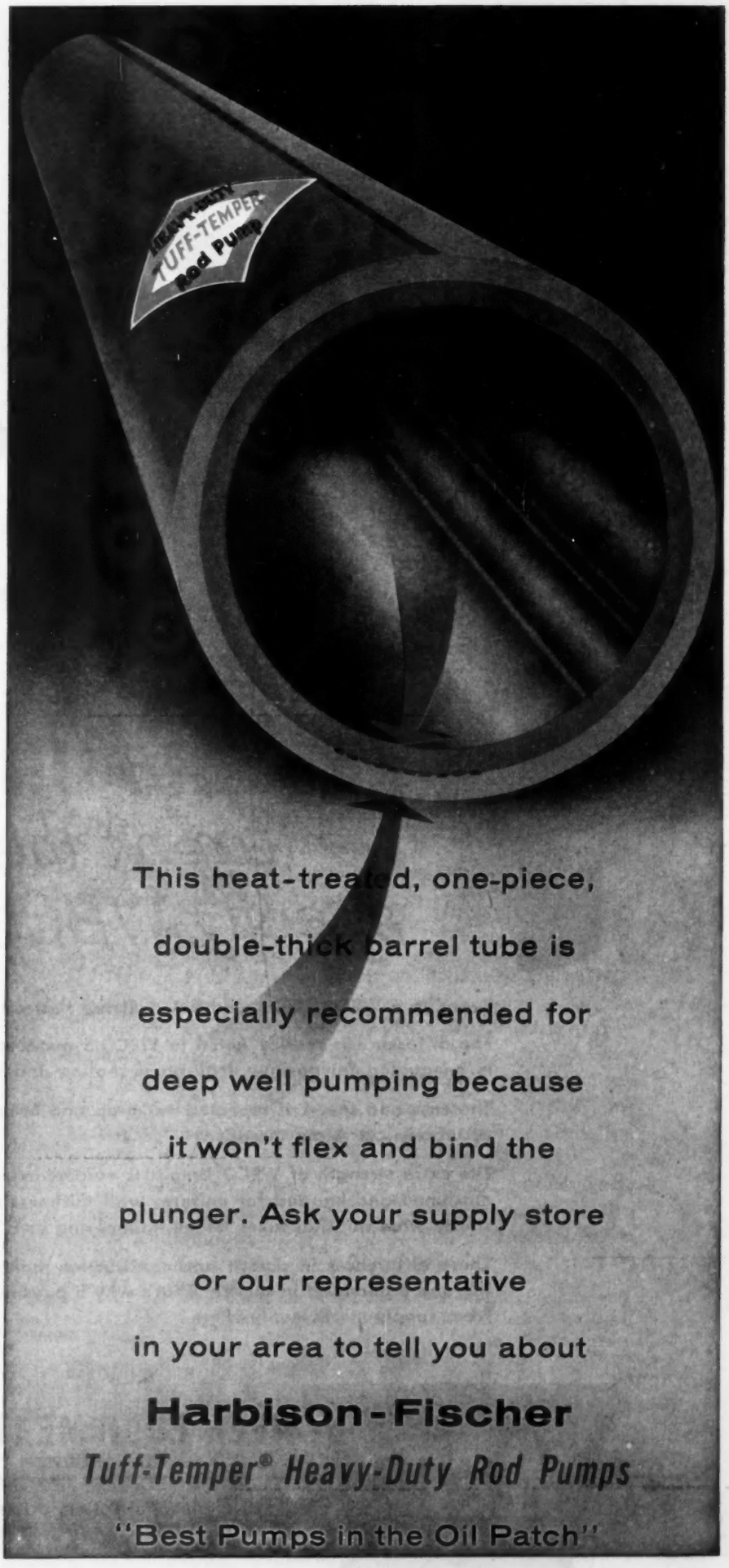
**C. M. Ferree**, division geophysicist for Conoco at Casper, Wyo., will succeed Black in Denver as assistant regional geophysicist. Black joined Conoco in 1944 and served on geophysical crews in several states before transferring to Denver in 1948 as a geophysical supervisor. He was division geophysicist at Billings for three years before returning to Denver in 1955 as assistant regional geophysicist. Ferree became associated with Conoco in 1948 as a Shoran operator for a marine seismograph crew on the Gulf Coast. He later served on several geophysical crews and held key positions in company exploration offices in Houston, Denver and Casper.

•

**Dr. Frank E. Byrne** has been advanced to district geologist of **Tidewater Oil Company's** Casper district Exploration office. In this post Byrne will assume direction of the company's geological exploratory operations in the Rocky Mountain district. He will be headquartered at the company's exploration office at Casper, Wyo. He joined Tidewater in 1955 as a stratigrapher for the Casper district.

•

**Horace G. Peterson** has been appointed to the new position of assistant to the executive vice president of **Standard Oil Company (Indiana).** Peterson, formerly assistant manager-reseller of the company's Huron, S. D., Sales division, will report to **Robert C. Gunness,** executive vice president, in the general office at Chicago. Peterson joined Standard in 1939 as a clerk at La Crosse, Wis. In 1946 he was transferred to the general office in Chicago as an aviation salesman. He





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**The ease and speed of repeated make-up and break-out is apparent in the sturdy, accurately cut Acme threads.**

**The extra strength of WECO Unions is evident in the heavier wall sections that are machined and knurled for uniform wall thickness and safer wrenching . . . in the sturdy wing nut that takes heavy hammering as a matter of course.**

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was made assistant sales manager at Minneapolis, Minn., in 1948 and sales manager at Joliet, Ill., later that year. He returned to the general office as a sales manager in 1950 and was promoted to assistant manager at Huron in 1952.

•

**J. Ronald Getty** has been elected a director of **Tidewater Oil Company.** For the past two years Getty has served as managing director of Veedol G.m.b.H., Tidewater's marketing subsidiary in West Germany, with headquarters in Hamburg. In addition, he has been manager of the company's export activities in Europe, the Middle East and Africa.

J. Ronald Getty

•

**Drilling and Exploration Company, Inc.** announced the association of **Jack E. Hughes** with the company as geologist, with headquarters in the Republic National Bank Building, Dallas. Hughes previously was associated with Atlantic Refining Company and D. D. Feldman Oil & Gas.

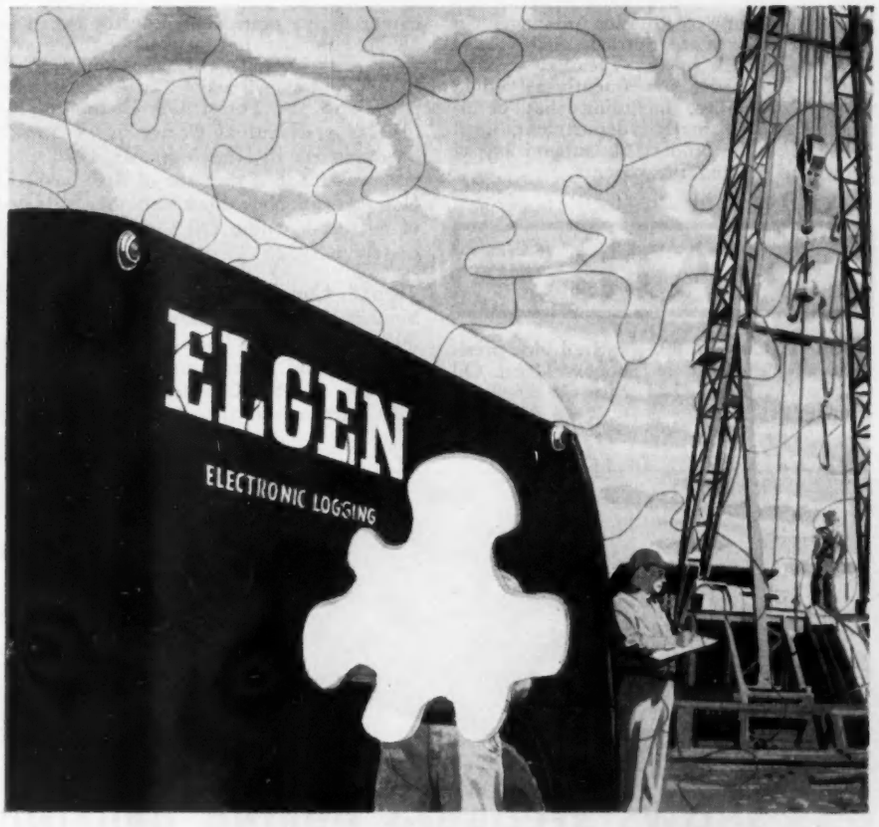
•

**Melvin J. Hill** has been appointed director of the Geology and Geochemistry division of the **Gulf Research & Development Company,** research subsidiary of Gulf Oil Corporation. Formerly division geologist for the Western Gulf Oil Company in Los Angeles, Hill, in his new position, will direct the activities of the division which is charged with the responsibility of developing new knowledge and new techniques in geology to aid the exploration geologist in studying rocks from the standpoint of the generation, migration and accumulation of oil in commercial traps. He joined Western Gulf in 1941 as a geologist in the Geological department. In 1947 he was named area geologist in Bakersfield, Calif., and since 1951 has served as division geologist. Hill will make his new headquarters at the research laboratories at Harmarville, Penn.

•

**Gulf Oil Corporation** elected **S. G. Sanderson** a vice president and **John S. Sprowls** assistant treasurer. Sanderson is division manager of the company's Tulsa Production division and is responsible for Gulf's crude oil activities in Oklahoma, Kansas, Illinois, Michigan, Nebraska and several other adjacent states. Sprowls will be in charge of the newly created section of the Treasury department—loans and related investments—and will have direct responsibility for financial negotiations relative to these activities. Sanderson first joined Gulf in the Natural Gas department at Kiefer, Okla., in 1913. Four years later, he was transferred to Shreveport, La., and placed in charge of the Natural Gas department. In 1919, he was transferred to Tulsa and made superintendent of the Natural Gasoline plants there, appointed general superintendent of Production for the Gypsy Oil Company, a Gulf subsidiary, in 1929. He worked in that capacity until 1952 when he was made manager of production for the Tulsa division.

Sanderson was appointed to his most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recent position of division manager in April of last year. Sprowls first joined Gulf as a clerk in the Treasury department in 1949. He subsequently served in various capacities, including that of financial analyst in that department, until 1956 when he undertook supervision of loans and related investments.

## DEATHS

**Arthur F. Corwin,** 80, a retired vice president and director of Socony Mobil Oil Company, Inc., died March 13 in a Bronxville, N. Y., hospital. Corwin's career in the petroleum industry began in 1899. His first job was with the South Penn Oil Company, Mannington, W. Va. Later he was with the Carter Oil Company and the Forest Oil Company. He became president of Carter in 1915 with headquarters in New York. In 1926 Corwin was made a director of Standard Oil Company of New York and then director of Socony-Vacuum Oil Company, its successor, in 1932.

**John F. Conway,** 62, publicity director of Sinclair Oil Corporation, died December 30 in a New York hospital. Well known to financial and petroleum writers throughout the U. S., Conway joined Sinclair in its Advertising department in 1923.

**Lloyd E. Farley,** 61, died in Port Allen, La., February 15. He was president of L. E. Farley, Inc., pipe line contractors.

**F. B. Parriott,** 78, director of Sunray Mid-Continent Oil Company, died February 5 in a Tulsa hospital.

**Charles A. Chipman,** oil producer and president of the Pennsylvania Grade Crude Oil Association since 1953, died near Deland, Fla., March 7. Chipman was the first president of the Association from the Allegany County, N. Y., oil field. He was a member of the board of directors of the American Petroleum Institute and the National Petroleum Council. He had been in the oil business since 1918. He was a partner in several oil companies.

**William H. Moran,** 67, president of the E. F. Moran, Inc., oil drilling firm, died March 6 after a six-month illness. Moran formed his drilling company after retirement in 1948 from The Texas Company as superintendent of the Pipe Line division.

**George P. Gentry,** 62, manager of the Materials department of the Phillips Petroleum Company, Bartlesville, Okla., died March 3.

**William Woodward,** 78, retired oil developer credited with bringing in the first oil well in the Huntington Beach field, died February 21 in South Pasadena, Calif. A retired machinist and engineer, he organized and owned the Huntington Beach Oil Co.

**Lloyd Snyder,** 71, retired district superintendent of the Mid-Continent Petroleum Corporation, died February 17. Snyder, active in Oklahoma oil circles since 1919, established a Mid-Continent district office in Arkansas City until the office was moved to Wichita in 1936 where he continued as superintendent until retiring in 1950.

**Myer Stekoll,** 42, died February 18. He operated the Myer Stekoll Pipe and Supply Company and was also an oil producer.

**Stanley A. Thompson,** 71, president of the Westbrook-Thompson Holding Corporation and secretary-treasurer of Westbrook Oil Corporation, died February 19. Thompson also held individual oil holdings over the Southwest, independent of the two firms.

**William A. Black,** 68, retired drilling contractor, died March 21 in a hospital in Oklahoma City. Black was employed by The Texas Company for a time and later became an independent drilling contractor and was associated with the late Jimmy Lang in the Black-Lang drilling firm. He retired in the late 1930's.

**George L. Noble,** 88, retired vice president of The Texas Company, died April 11 at a meeting of the annual Texas Old-Timers Club in Houston.

**William G. Skelly,** 78, died April 11 in a Tulsa hospital. The oilman and philanthropist was chairman of the board of Skelly Oil Company.

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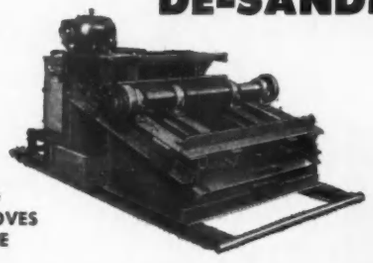

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**To establish conclusive proof of the accuracy of our geophysical work, we will, without cost to you, test and record a log of your well on tape, bearing your signature and ours, of your rank wildcat location, in advance of drilling, indicating the existence or not of petroleum in commercial quantities underlying the tested areas and approximately at what depth it may be found. The instruments are entirely self-operating during testing period.**

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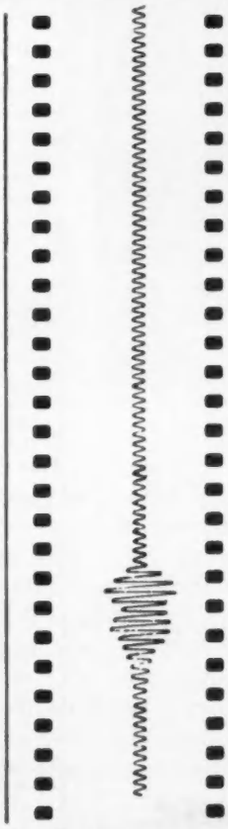
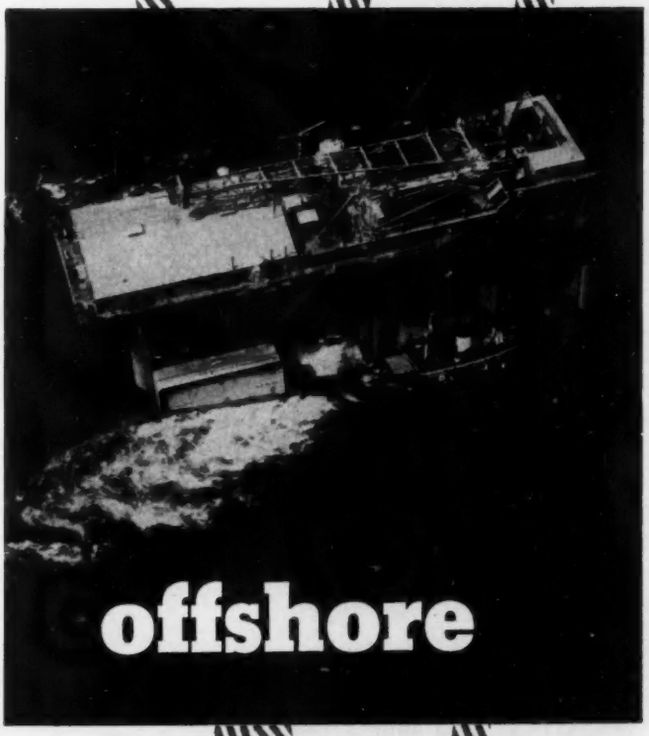


**Specimen of log tape indicating saturation with break in zone**

**the busiest towlines**



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# New Books, Maps and Movies

**1956 STRUCTURE MAPS OF TEXAS OIL FIELDS**, Rinehart Oil News Co., P. O. Box 1208, Dallas, $17.50.

Bound in two volumes, this 271-page third annual edition contains reproductions of structure maps as submitted during 1956 to the Texas Railroad Commission by operators for rulings on field discoveries, injection projects and Rule 37 permits.

Exhibits are identified by district, county, name of contoured formation and interval, scale and type of hearing, and are assembled and indexed by Texas Railroad Commission districts. Also included is a multi-colored map showing districts by counties and an alphabetical list of counties by districts.

•

**1957 EXECUTIVE MAP, PRODUCING FORMATIONS OF THE PERMIAN BASIN**, Southwest Mapping Company, 1105 Continental Life Building, Fort Worth 2, Texas.

All the oil fields in the Permian Basin are shown in colors in this map, classified according to formations from which they produce. The colors are superimposed over a base map showing sections, surveys, towns, railroads and field names. Wildcat dry holes and drilling wells to Feb. 1, 1957, are identified by operator and farm names and total depth.

In order to show more details than on previous editions, the scale has been enlarged to 4 miles to 1 inch, the size to 4 by 5½ feet, greatly improving legibility. This necessitated printing the map in North and South sections due to press limitations, but they will match together, making a valuable ready reference map for your wall, file or brief case.

•

**FIVE YEAR DEVELOPMENT MAP**, Midland Map Company, 412 N. Big Spring Street, Midland, Texas, $5.

This map covers development in the Permian Basin area for the years 1952 through 1956. Each year's development is shown in a different color.

A perspective of development in this rapidly expanding oil empire is provided. Geologists will find it a quick reference map for checking the year of discovery. Exploration managers will find it useful for illustrating reports.

The map is 26 inches by 28 inches. Scale: 1 inch equals 64,000 feet. It also shows the main roads, important towns and county outlines.

•

**ENTERPRISE IN OIL**, Kendall Beaton, Appleton-Century-Crofts, Inc., 35 West 32nd St., New York City, $7.50.

The author has written about the history of Shell Oil Company in America. After explaining the organization of the Royal Dutch Shell group, this book traces the growth of Shell Oil Company from its start in 1912 as the West Coast marketing firm, American Gasoline Company and an Oklahoma producing unit, Roxana Petroleum.

A complete corporate history is provided, encompassing the charter and growth of Shell and its affiliates, Shell Chemical Corporation, Shell Development Company and Shell Pipe Line Corporation.

A special chapter describes the exciting booms at Signal Hill, Calif., with drilling rigs base-to-base. Illustrations include eight line drawings, seven maps, and 149 halftone illustrations.

•

**ASSIGNMENT: VENEZUELA**, Creole Petroleum Corporation, 1230 Avenue of the Americas, New York 20.

A new film, produced by Creole, Venezuelan affiliate of Standard Oil Company (New Jersey), was released recently.

The motion picture is a 24-minute sound film in color which depicts the life of a young petroleum engineer from the U. S. who takes an assignment with Creole in Venezuela. It not only shows how he adjusts to his work in a foreign country, but also illustrates much of the environment of his new home—including many of the highlights of Venezuela's cultural and economic way of life.

"Assignment: Venezuela" supplements "People and Petroleum" a black and white motion picture released last year by Creole as a documentation of the economic de-


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8 *if by boat . . .*

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**92.8 hp @ 1800 rpm**

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**76.8 hp @ 1800 rpm**

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**68 hp @ 1800 rp**

**U-264-6**
**57.5 hp @ 1800 rpm**

**U-220**
**49 hp @ 1800 rpm**

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**U-281**
**65.5 hp @ 1800 rpm**

**U-175**
**43.3 hp @ 1800 rpm**

**U-123**
**22.3 hp @ 1800 rpm**

**U-1**
**10.5 hp @ 1800 rpm**

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Now, these 10 new and increased horsepower International oil field engines give you a bigger than ever bargain in usable pumping power per dollar. Ranging from 10.5 to 106 hp at 1800 rpm continuous duty speed on natural gas, these International power units all give you the most dependable power at the lowest cost for the longest time.

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Cut your pumping costs two ways: specify International power on your new equipment; or call in your nearby International Power Unit Distributor or Dealer when it's time to repower. He'll give you a money-saving power recommendation that fits your needs. And you'll find he can be counted on for prompt service and the parts you need when you need them most.

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velopment of Venezuela and the part played therein by the oil industry.

This new picture is Creole's first color film for U. S. audiences, and it will be widely distributed to television stations, civic groups, women's organizations and other non-theatrical outlets. Distribution of both films will be made through Sterling-Movies U. S. A. for television showings, and through Modern Talking Picture Service for adult groups and other non-theatrical audiences.

The film was produced for Creole by Sound Masters, Inc.

•

**DIRECTORY OF JOINT PETROLEUM SOCIETIES OF FORT WORTH,** Carl Hoera, Continental Geophysical Co., 2111 Continental Life Bldg., Fort Worth, Texas, $5.

The directory for the period 1956-57 is off the press. The 208-page hard-cover book contains photographs and biographies of members of the AIME section, Geological Society, Geophysical Society, Landmen's Association, and Petroleum Engineers Club.

•

**PETROLEUM REVIEW, LEA COUNTY, NEW MEXICO,** Phifer Petroleum Publications, P. O. Box 20024, Houston 25, $20.

The new 293-page oil reference book is the first the company has published on a New Mexico county, but is the eighth in a series that has covered eight counties in the Permian Basin of West Texas from Yoakum and Terry on the north to the Pecos River south.

Petroleum Review outlines the discovery, development and production of 184 oil and gas pools since 1926. During 1956 the county produced its one billionth barrel of oil since the original discovery in Maljamar pool.

The format of the new oil reference is the same familiar one used in the previous books on West Texas. Facts and figures were compiled by Robert L. Phifer from the records and hearing files of the New Mexico Oil and Gas Conservation Commission at Hobbs and Santa Fe. The book contains 86 illustrations among which are structure maps presented as exhibits by operators at hearings before the Conservation Commission and logs of discovery wells. There is a county map with the pools in color, a geological chart, a discovery chart and a handy production chart for quick reference.

•

**PUMPS SELECTION AND APPLICATION,** by Tyler G. Hicks, McGraw-Hill Book Company, Inc., 330 West 42nd St., New York 36, $8.50.

More economy and efficiency in pump usage is the aim of this book. Hicks is an instructor in mechanical engineering for Cooper Union School of Engineering. He discusses the basic types of pumps and problems met in pump installation application.

Step-by-step procedures for analyzing a pumping problem, finding the most suitable commercial pump for the job and applying this pump to the conditions encountered are outlined thoroughly in the book. Four hundred illustrations accompany the problems and pump types.

•

**SUMMARY SECONDARY RECOVERY OPERATIONS IN KANSAS DURING** 1955, Interstate Oil Compact Commission, Kansas Secondary Recovery Committee, Dr. Charles F. Weinaug, chairman.

This report contains information previously published in Bulletin No. 122, State Geological Survey of Kansas, 1956. Data on 188 projects located in Kansas are included together with a map of the eastern Kansas producing area as of Dec. 31, 1955. This map shows the areas which are now under secondary recovery operations.

During 1955 it is estimated that 15.1 million barrels of oil were produced from these secondary recovery operations. Greenwood County, alone, produced more than 5.4 million barrels of oil by secondary recovery methods. In addition to Greenwood County, six other counties produced more than half of their total oil from secondary recovery operations.

•

**PROPERTIES OF PETROLEUM RESERVOIR FLUIDS,** Emil J. Burcik, John Wiley & Sons, Inc., New York, $7.50.

Continual introduction of new methods and techniques plus varying economic conditions have made petroleum engineering a constantly changing field. Despite these changes, there are certain basic concepts on which the art is based. This book describes in a logical sequence these concepts in so far as reservoir fluids are concerned. It describes not only the properties of ideal fluids but also provides empirical correlations necessary for a more realistic approach to the complex systems that exist in petroleum reservoirs.

The author is associate professor of petroleum and natural gas engineering of The Pennsylvania State University.


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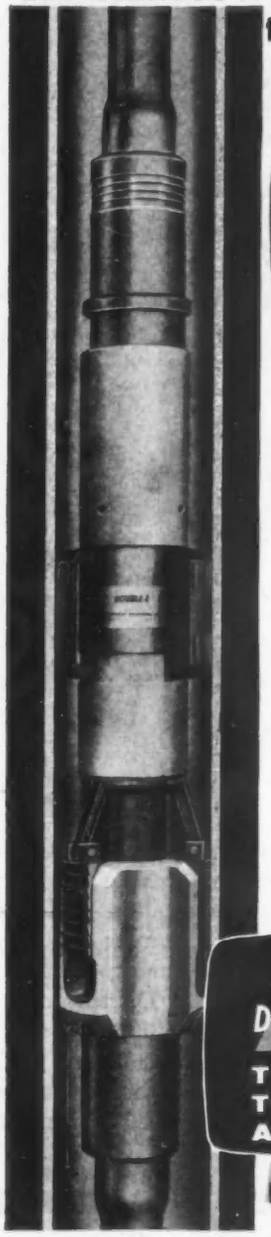

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# What's Happening

## AMONG INDUSTRY ASSOCIATIONS

### *Nomads Learn of Canada's Operating Problems*

**Houston chapter of Nomads at its April monthly meeting was treated to an illustrated description of operating problems in the vast areas of Western Canada, given by Tom Gaines of Texaco Exploration Company, Calgary. Special guests for the meeting were left to right standing: Alfredo Salinas, E.N.A.P., Punta Arenas, Chile; John B. Williams, Iraq Petroleum Company, Iraq; D. C. Wilkins, Qatar Petroleum Company; Tom Gaines; Cary Prince, Edwin W. Pauley Company, Reynosa, Mexico; and Tucker Pennington, Humble Oil & Refining Company, Houston. Kneeling at the left are Don Harlan, The Texas Company, Houston, and W. L. Reynolds, Cameron Iron Works, Inc., Houston. Seated at the right are Martin Newell (back), Tidewater Oil Company, Ventura, Calif., and Martin Mears (front), superintendent, STA, Turkey.**

### AIME Is Now Operating By Reorganized Structure

Following action taken at its recent annual meeting in New Orleans, the American Institute of Mining, Metallurgical, and Petroleum Engineers (AIME) now conducts its activities through a reorganized structure.

Previously known as the Mining, Metallurgical and Petroleum Branches of AIME, these units now are the Society of Mining Engineers of AIME, the Metallurgical Society of AIME and the Society of Petroleum Engineers of AIME. Though each has its own officers and administrative set up, the three constituent societies remain under control of the AIME board of directors.

### Production Pioneers Elect Officers in Los Angeles

At the annual meeting of the directors of Petroleum Production Pioneers, held in the Petroleum Club of Los Angeles recently, the following officers were elected: honorary president, Ben E. Parsons, General Petroleum Corporation, retired; honorary vice president, Frank R. Seaver, Hydril Corporation; president, Fremont R. Schnieder, Shell Oil Company; vice president, T. H. Wallace, Western Gulf Oil Co.; treasurer, Douglas G. Kingman, General Petroleum Corporation; secretary, R. Sneddon, Petroleum Club of Los Angeles; historian, Paul Andrews, Signal Oil & Gas Company; and sergeant-at-arms, Thomas E. Morton, Halliburton Oil Well Cementing Company.

### Skahan, Ackerman Take New Duties with OIC

Donald R. Skahan has been appointed director of creative activities, and Floyd F. Ackerman has been assigned the duties of advertising supervisor of the American Petroleum Institute's Oil Information Committee. It was also announced that Peter T. Mulhare will join the API staff as production supervisor.

Skahan has been on the API staff since 1951 as production supervisor. In his new position he will supervise and coordinate all activities relating to editorial production, research, publicity, advertising and the film program.

Ackerman joined the API in 1953 as supervisor of the employe information program and a year ago also assumed the responsibilities of the film program. Prior to 1953 he was associated with Public Relations departments of The American Cyanamid Company and Tide Water Oil Company. He will continue to supervise the employe information and film programs.

Mulhare comes to the API staff from the Italian Line, where he was assistant advertising manager.

### Kenney Is APIC Chairman; O'Brien New Vice Chairman

William F. Kenney, vice president and general counsel of Shell Oil Company, has been elected 1957 chairman of the American Petroleum Institute. He succeeds Robert H. Scholl, vice president and director of Esso Standard Oil Company, who has been chairman the past two years.

Henry L. O'Brien, general counsel and director of Cities Service Company, was chosen to succeed Kenney as APIC vice chairman. Kenney has been a member of the committee since Jan. 1, 1953, and vice chairman since 1955.

Kenney joined Shell's legal staff at St. Louis in 1937 and after serving some years with the company there and at Houston, was transferred to the New York office in 1945. In 1946 he was named manager of Shell's Legal department in New York and assistant secretary of the company. Subsequently he was designated a general attorney of the company, and in January, 1953, became vice president and general counsel.

O'Brien, who has been a member of the APIC since January, 1955, as an attorney was associated with the law firm of Frueauff, Robinson and Sloane from 1921 to 1936, and from 1936 to 1940 was a partner in the firm of Frueauff, Burns, O'Brien and Ruch. He became vice president and a director of Cities Service Company in 1940, and since 1950 has been general counsel, director and a member of the executive committee.

### Petroleum Clubs Offer Reciprocal Guest Privileges

The Petroleum Club of Los Angeles has announced that reciprocal guest privileges have been negotiated with a number of out-of-state petroleum clubs. These clubs now include Olney, Ill.; Abilene, Texas; Denver; Wichita, Kansas; Tulsa; Edmonton, Alberta; and Casper, Wyo.

Members signing out-of-state club chits will be billed directly by those clubs. Other clubs may be added to the above list as negotiations continue. Exchange privileges apply only to resident members.

### AIME Creates Section In Upper Mississippi Valley

Establishment of the Upper Mississippi Valley section has been announced by the American Institute of Mining, Metallurgical, and Petroleum Engineers. It comprises the counties of Jo Davies and Stephenson in Illinois; the counties of Allamakee, Clayton, Dubuque and Jackson in Iowa, and the counties of Crawford, Grant, Iowa, Lafayette, Richland and Sauk in Wisconsin.

A student chapter, to be known as the Geology Club, has been established at the University of Syracuse.

## Geophysicists Nominate Eight for June Election

Eight geophysicists have been nominated for office in the Society of Exploration Geophysicists. For president, O. C. Clifford, Jr., chief geophysicist for The Atlantic Refining Company, Dallas, will oppose H. M. Thralls, president of Geo. Prospectors, Inc., Tulsa.

Otis B. Hocker, manager of the Geophysical division of The Texas Company, Houston, and Ben F. Rummerfield, executive vice president of Century Geophysical Corp., Tulsa, have been nominated for vice president.

For secretary-treasurer Howard E. Itten, president of Empire Geophysical, Inc., Fort Worth, Texas, will be opposed by Curtis P. Harkins, vice president of Independent Exploration Company, Houston.

L. Y. Faust, geophysical supervisor for Amerada Petroleum Corp., Tulsa, will oppose E. J. Stulken, chief seismologist for Geophysical Service Inc., Dallas, for the two-year term of editor.

Members will be eligible to cast their ballots by mail in June. The officers elected at that time will start their terms next November during the twenty-seventh annual meeting in Dallas.

## Bell Is 1957 President Of Louisiana Geophysical

The Southwest Louisiana Geophysical Society has elected its officers for the year 1957. John W. Bell, Jr., is president.

First vice president is A. V. Hargis; second vice president, W. W. Daly; and secretary-treasurer, Lawrence Ott.

Organization plans for the New Orleans regional chapter of AAODC are discussed by the new officers. Left to right are Earl G. Bateman, chairman; Charles A. Norton, vice chairman; Brad Mills, executive vice president, Dallas; and Charles F. Hayes, chapter secretary-treasurer.

## Seventeenth AAODC Group Formed in New Orleans

The seventeenth regional chapter of the American Association of Oilwell Drilling Contractors has been organized in New Orleans, La., with Earl G. Bateman, Bateman Drilling Co., as chairman.

Other officers named at the organizational meeting last December were Charles A. Norton, Norton Drilling Co., vice chairman, and Charles F. Hayes, Rimrock Tidelands, Inc., secretary-treasurer.

Brad Mills, AAODC executive vice president, said the New Orleans regional chapter will include the area south of Baton Rouge and east of Morgan City in Louisiana, and southern Mississippi.

## PPROA Annual Meeting To Hear Dr. A. A. Smith

A program punctuated with nationally known personalities in the oil and gas business has been arranged for the annual meeting of the Panhandle Producers and Royalty Owners Association scheduled for May 9 in the Herring Hotel, Amarillo, Texas, according to John G. O'Brien, PPROA president.

Frank J. Storm, Jr., partner in the firm of Storm, Hagy and Hermann of Amarillo, independent oil and gas producers, has been named overall chairman of arrangements for the annual event. His assistant is George Cree, Jr., of the Cree Companies, independents of Pampa, Texas.

Lawrence R. Hagy, prominent in oil and gas circles from his headquarters in Amarillo, is program chairman. Hagy has lined up a roster of platform performers including Dr. Arthur A. Smith, vice president in charge of public relations of the First National Bank of Dallas; Lt. General Ernest O. Thompson, member of the Texas Railroad Commission; and many others.

The position of executive vice president of the Panhandle petroleum organization recently was taken over by Porter L. Oakes, Amarillo public relations man. Oakes, former newspaperman and editor on Texas and Tennessee daily newspapers and publisher of several trade publications, has had a diversified experience in trade association and allied fields. He succeeds W. Clyce Stallings, who resigned his PPROA executive's job to take a position with the Shamrock Oil and Gas Corporation in Amarillo.

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# Companies in the News

**OFFSHORE CONTRACTORS, INC.** positioned its mobile drilling platform Pacific Driller #1 off the California coast near Summerland to begin preliminary testing of the 5500-acre state lease held by Standard Oil Company of California and Humble Oil & Refining Company. The platform drilled a deep core hole seeking further geologic information for the leases on station about 1½ miles offshore and south of the town of Summerland. Depth of the water in that area is 76 feet. If favorable indications result from the test, consideration will be given to establishing a platform at the site for exploratory drilling. The lease awarded for a bonus bid of $7,250,000, is for land classified as "wildcat." It is the first such lease awarded under provisions of the Cunningham-Shell Act of 1955.

•

**CITIES SERVICE COMPANY** has contracted for the construction of three of the world's largest supertankers, each with a deadweight tonnage of 65,000. Each will have a capacity of 556,300 barrels or 23,364,600 gallons of oil. In terms of home heating oil, each ship would be able to supply, on a single voyage, the heating requirements of 15,500 average houses for an entire year. The same quantity of gasoline would run 113,500 automobiles from New York to San Francisco, or fuel 510 stratocruisers on a flight around the world. A single cargo of diesel oil would fuel a modern locomotive on a run of 4,600,000 miles. The new vessels will be built in the Uddevalla Shipyard on the west coast of Sweden. Delivery of the first vessel is scheduled for June, 1959. Each vessel will have a speed of 16½ knots and will incorporate the most modern design in all phases of ship construction. Aggregate cost of the three ships is estimated at $33,750,000. Each ship will have a length of 816 feet, a beam of 116 feet and a draft of 41 feet 3 inches.

•

**STANDARD OIL COMPANY (INDIANA)** has acquired all outstanding common stock of Schrock Bros. Co. fertilizer firm at Congerville, Ill. Under terms of an offer from shareholders of Schrock Bros., Standard Oil purchased the common stock shares. The company will continue in business as a Standard Oil affiliate principally for the sale of anhydrous ammonia in Illinois, Indiana, Iowa, Nebraska and Kansas. **W. O. Frazier,** former assistant sales manager for Standard Oil at South Bend, Ind., was elected president and a director of the company. **J. B. Schrock,** who is a member of the board of directors, will continue to be active in company operations.

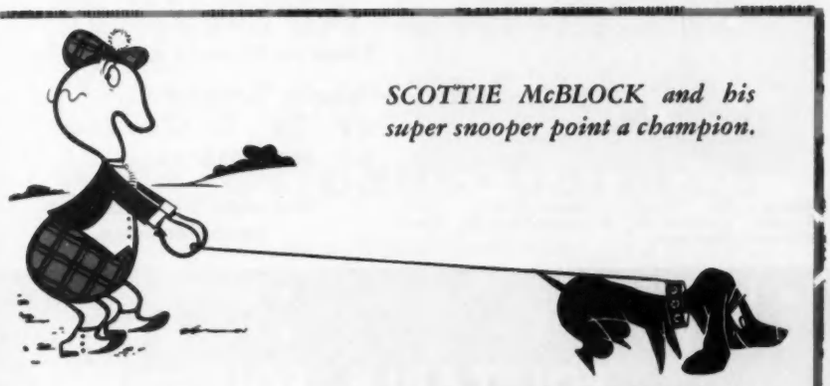
•

**DELTA DRILLING COMPANY,** with main offices at Tyler, Texas, has simplified its corporate organization and its operations by merging into it some of its domestic wholly owned subsidiaries. These are Delta Gulf Drilling Company, engaged in contract drilling and oil and gas production, Algord Oil Company and Creek Oil Company, engaged solely in the production of oil and gas. These companies have been liquidated as of December 31 and all of their assets have been transferred to Delta Drilling Company, which has assumed all of their financial and contractual obligations. All of the personnel of these companies will pass into Delta Drilling Company without change of position, responsibility or seniority. Effective at the same time, Delta Drilling Company's two Venezuelan subsidiaries, Perforaciones Guarico C. A. and Perforaciones Delta C. A. were merged in the latter company, to which all properties have been transferred and which has assumed all the obligations of the former.

As now reorganized, Delta Drilling Company will conduct drilling operations and exploratory and producing activities in the continental U. S., except offshore work which will be handled by Delta Marine Drilling Company with offices in New Orleans. Contract drilling in Venezuela and other South American countries will be carried on through its subsidiary, Perforaciones Delta C. A., with offices at Caracas, and European and Near East contract drilling through its subsidiary, Compagnia Industrie Metanifere E. Affini (CIMA), with offices in Rome, although some foreign drilling contracts will still be handled directly by the parent company.

•

**D-X SUNRAY OIL CO.** has announced the addition of four more oil marketing firms to its credit card interchange, effective last January 1. They are Imperial Oil, Ltd., which operates in Canada; Standard Oil Company of Texas, operating in New Mexico and that part of Texas west of the Pecos River; the California Com-

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pany, operating in Wyoming, Montana, Colorado and Nebraska; and Signal Oil Company, operating in California, Oregon, Washington, Idaho and Utah.

•

**OCEANIC OIL COMPANY** announced it had purchased all of the stock of the **W. M. & M. Oil Co.**, a California corporation, producing approximately 217 net barrels per day from three properties in the West Coalinga area, Fresno County, Calif. The principal property involved is a 40-acre fee parcel producing ⅔ of the net daily production. **J. Russell Sherman**, president of Oceanic, announced that W. M. & M. had been dissolved effective Dec. 31, 1956, and was absorbed into the operations of Oceanic. Oceanic's net production is currently 2101 bpd.

•

**TIDEWATER OIL COMPANY** established a district exploration office at Durango, Colo. **Paul E. Carlton** has been transferred from Tulsa to Durango to serve as district geologist. **Joe Malloy**, landman, and **Homer E. Olivier**, geologist, also are assigned to Durango. The Durango office will serve the "Four Corners" area of southwest Colorado, southeast Utah, northeast Arizona and northwest New Mexico.

•

**MESA DRILLING COMPANY**, wholly owned subsidiary of Camay Drilling Company of Compton, Calif., announced it will operate under the name of **CAMAY DRILLING COMPANY**, Rocky Mountain division. There will be no change of management or personnel. The Rocky Mountain division office will retain its present address in the Denver Club Building, Denver, Colo., with **M. D. McBride** as division manager and **F. B. (Buster) Link**, division drilling superintendent.

•

**MASCOT OIL COMPANY** board of directors has offered to transfer substantially all of the assets of Mascot to **Mt. Diablo Company** on the basis of 1.6 shares of Mascot stock for one share of Mt. Diablo stock. It has been accepted by the Mt. Diablo board, according to a joint announcement by **T. D. Bonney**, president of Mt. Diablo, and **Ross McCollum**, president of Mascot. Both the offer and acceptance are subject to the approval of stockholders of the two companies. Both companies are producers of oil in the Taft area of Kern County, California.

•

**P L D WELL SERVICE COMPANY** has changed its name to **LUSK DRILLING COMPANY.** P L D, originally a partnership, was formed nearly 15 years ago; however, "P" and "D" have each gone their separate ways, forming their own companies. Lusk will continue to operate primarily in the Gulf Coast area. Two new rigs are now in operation. They are a Bethlehem M-810 and a Cardwell Trailerig.

•

**BYERS EXPLORATION COMPANY** has been formed by **John W. Byers.** He was formerly vice president of McCollum Exploration Company and later a partner in State Exploration Company. The company will engage in seismic, gravity surveys and as consultant geophysicists. It is located at 709 M & M building in Houston.


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# What's Happening

## AMONG SERVICE AND SUPPLY MEN

T. Sutter (left), new president of Baker Oil Tools, Inc., congratulates R. C. Baker, retiring president, during ceremonies held at company headquarters in Los Angeles. In the background is a bronze bust of Baker. The bust was presented to Baker by employes of the company and will be permanently displayed in the Los Angeles office.

### R. C. Baker Resigns as Baker Oil Tool President; T. Sutter Named to Post

**R. C. Baker,** chairman of the board and president of **Baker Oil Tools, Inc.,** since its foundation, resigned on April 10 as president of the company. **T. Sutter,** who since 1930 has served as executive vice president and general manager, was elected president. All other directors and officers, including **R. W. Henderson,** vice president and assistant general manager in charge of the company's Central division, were re-elected. Baker, who has been active in the oil industry for some 63 years, was honored on the occasion by a ceremony attended by company officials, and office and plant employes. He was presented a full color photographic portrait of himself made by Gittings, of Houston; also a bronze bust created by Barnhart Lemmel, Dean of the Art School at the University of Houston. R. W. Henderson, on behalf of all Baker employes, presented the portrait, and R. C. Anderson, a grandson, presented the bronze bust. These tokens of the esteem of Baker employes are to be permanently displayed in the company's Los Angeles office.

One of the truly "old timers" in the oil industry, Baker started his oil industry career in the Los Angeles area in 1894, driving a two-horse team hauling crude oil for $2 for a 12-hour day. Within two years he was contract drilling in the old Los Angeles field and, in 1899 started contract drilling of wells in the Coalinga area near the northern end of the San Joaquin Valley. In 1907, by then superintendent for several oil companies, he introduced the first rotary equipment in the Coalinga fields by importing two rotary crews from Texas, where rotary drilling operations had started in 1901. In 1907 he developed the Baker Casing Shoe, an invention upon which in 1913, was founded the Baker Casing Shoe Company. Manufacture of the shoe was started in 1918 in a machine shop. The three employes then constituting the Baker staff is to be contrasted with today's more than 1400 employes. In 1922, with the opening up of the Signal Hill and Santa Fe Springs oil fields in the Los Angeles Basin, general offices of the company were moved to Huntington Park, near Los Angeles, and a modern factory was built. By then the number of employes had grown to 12. An office building and plant were built in Houston in 1936, and in 1950 the present Los Angeles plant and general offices was completed. The company now has 60 branch warehouses in the U. S. and, through a wholly-owned subsidiary, Baker Transworld, Inc., serves Canada and Venezuela.

The new president, T. Sutter, entered the employ of the company in 1922, and a year later was appointed secretary-treasurer and assistant general manager. He became executive vice president and general manager in 1930, and thereafter held both offices until his election as president and general manager. He is a past president of Petroleum Equipment Suppliers Association. He is one of the founders, and the second president of the Los Angeles Chapter of Nomads. He currently is a member of the Executive Committee of Merchants & Manufacturers Association, Los Angeles; a vice president of Metal Trades Association of Southern California; and a senior member of the Petroleum Production Pioneers, having served for many years as its first historian.

•

**D. A. Irelan,** formerly field representative at Sterling, Colo., has been promoted to store manager and field representative at Thermopolis, Wyo., for **Bethlehem Supply Company. M. R. Griffith,** formerly machinery sales representative for the Southwest Texas district at Corpus Christi, Texas, has been transferred with the same title to the Gulf Coast division office. He will headquarter at Houston and promote the sale of pumping units and related equipment throughout the division. Griffith is replaced by **J. J. Caskey,** former machinery sales representative at New Iberia, La.

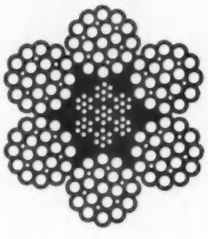
•

**Thermoid Company** voted to change the by-laws of the corporation so that the membership of the board could be increased from 9 to 15. To fill the vacancies the following were added to the board: Rear Admiral **John J. Bergen,** USNR, **Irving Mitchell Felt, Edwin M. Ost, Jr., A. Charles Schwartz, A. M. Sonnabend** and **Charles Wohlstetter.** Bergen is chairman of the boards of directors of Graham-Page Corporation and Hotel Corporation of America. Felt is president of Graham-Page Corporation, and he is also chairman of the executive committee of Hotel Corporation of America. Ost is vice president and treasurer of Graham-Paige Corporation. Schwartz is a partner in the investment banking firm of Bache & Co. Sonnabend is president of Hotel Corporation of America, chairman of the board of directors and president of Botany Mills, Inc. and president of Sonnabend Associated Properties, Inc. Wohlstetter is a partner in the firm of Seskis & Wohlstetter, members of the New York Stock Exchange, and chairman of the board of directors of Induction Motors Corporation. The board of directors of Thermoid also voted to increase the number of the Executive Committee to seven and elected Bergen, Felt and Sonnabend to fill the vacancies. The newly elected directors represent very substantial stockholdings in the company.

•

**Benjamin F. McIntosh, Jr.,** was appointed field representative for **United States Steel Corporation's** Oil Well Supply Division at Sherman, Texas. McIntosh was employed by Oilwell in 1952 at Graham, Texas, and was transferred to Sherman in 1955.

# WICKWIRE
# DOUBLE GRAY
# WIRE ROPE



An extra improved plow steel wire rope with independent wire rope core, Double Gray gives you a rated breaking strength that's 15% greater than the catalog breaking strength of ropes of the same size and type made from improved plow steel.

Double Gray is *not* a new rope . . . *not* a rope that's offered to you on an "experimental" basis. Instead, it's been thoroughly tested in both the field and the laboratory. This means that you can now get extra high strength ropes with greater abrasion and crushing resistance . . . *plus* the knowledge that you're using a *safe* wire rope that's made by a company long known for its top-quality products.

Contact your nearby Wickwire Distributor or CF&I sales office for complete details and recommendations for your particular applications.

**PRODUCT OF WICKWIRE SPENCER STEEL DIVISION**
**THE COLORADO FUEL AND IRON CORPORATION**

CF&I

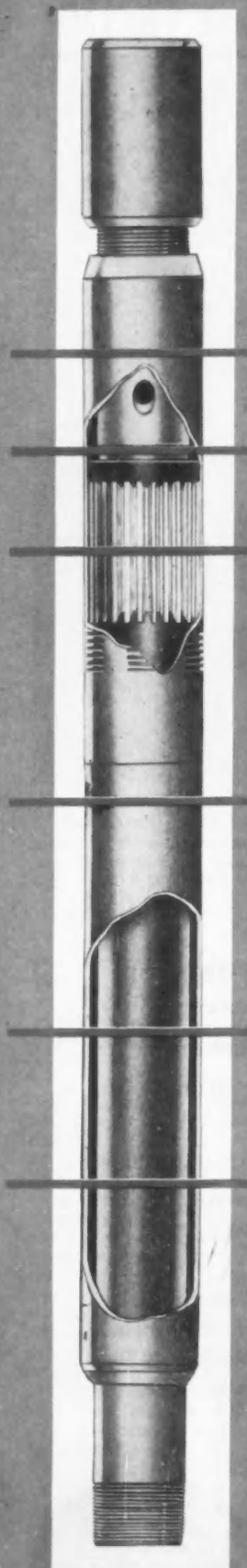
THE COLORADO FUEL AND IRON CORPORATION—Denver • Houston • Odessa (Tex.) • Phoenix • Salt Lake City • Tulsa
PACIFIC COAST DIVISION—Los Angeles • Oakland • Portland • San Francisco • Seattle • Spokane
WICKWIRE SPENCER STEEL DIVISION—Boston • Buffalo • Chattanooga • Chicago • Detroit • Emlenton (Pa.)
New Orleans • New York • Philadelphia

LOOK FOR THE YELLOW TRIANGLE

5078



For more data on advertised products, use Readers' Service Cards, last page.



*If your gas lift valves don't have these 5 features, ask about the*

# Otis Type C

Extra-large flow ports to assure ample gas supply for optimum lift efficiency.

Check valve that seals positively. Doesn't require velocity to close.

No metal moving parts. This resilient sleeve is the valve. Element effects bubble-tight seal, with small opening and closing differential. Same valves can be used for continuous or intermittent flow — without pulling tubing to change valves.

Only two forces operate the valve: Chamber pressure within the valve and casing pressure outside the valve. Valve is completely balanced . . . controlled at the surface . . . regardless of tubing pressure.

Concentric with tubing . . . easy to run and pull . . . no offsets, no unusual shapes. Available in 3/4" x 1 3/4" to 2 1/2" x 4" sizes.

*For details and illustrated literature, contact Otis Gas Lift Division, 2402 Broad Street, Houston.*

# Otis Gas Lift Valves

PRESSURE CONTROL - OTIS - SERVICE - EQUIPMENT

**OTIS PRESSURE CONTROL, INC.**


**The Staytite Company** in Houston recently elected **H. J. Glauser, Jr.**, president; **F. G. D. Muller**, vice president; **Wharton E. Weems**, secretary; and **C. C. Glauser, treasurer.**

Bill Fry

C. F. Grice

W. H. Throop

R. T. Wade

**Schlumberger Well Surveying Corporation** has announced 10 personnel promotions and new assignments. **R. T. Wade** has been named technical assistant to the vice president of field operations. Wade joined Schlumberger in 1934. He has served in Corpus Christi, Midland and Tyler, Texas; Ventura, Coalinga and Long Beach, Calif., and Winfield and Shreveport, La. Prior to his assignment to Houston, he was manager of the North Louisiana area in Shreveport. New sales engineers for Schlumberger are **V. A. Hertling**, Mt. Carmel, Ill.; **A. F. Stewart** at Flora, Ill.; and **M. R. Curtis** at Fort Morgan, Colo. **J. E. Ramsey** has been promoted to senior sales engineer at Corpus Christi and **G. F. Horst** assumes the same position for the Permian Basin division at Midland. **R. C. Barber** is now senior sales engineer at Wichita, Kansas. The new manager of the Tyler, Texas, district is **C. F. Grice.** Grice joined Schlumberger in 1950 and has been manager of the Monroe, La., district. **W. H. Throop** is transferred from Corsicana, Texas, to Monroe, La., where he assumes the position of location manager. **Bill H. Fry** has been named manager of the Snyder, Texas district. Prior to this assignment, Fry served as manager of the Monroe district and as sales engineer at Midland.

•

**John Veckly** was appointed director of the Advertising division of **United States Steel Corporation.** His entire business career has been in the advertising field beginning in 1926. He was first employed by Halle Brothers Company, Cleveland, Ohio, and became assistant advertising manager there. He joined the B. R. Baker Company in Cleveland in 1934 where he was assistant general manager. In 1941 Veckly went to the Curtis Publishing Company in Philadelphia, Penn. He was advertising and promotion manager for the Saturday Evening Post before accepting the position as assistant director of advertising with U. S. Steel in 1955. It was from

this position that he was named to his present appointment. Veckly succeeds G. R. Schreiner, who has been appointed special assistant in the office of the executive vice president, commercial.

•

Allen A. Staub

S. O. Beren

Max Beren

Don Morris

**Mountain Iron and Supply Co.** has made three top level moves. **Max Beren,** founder and president is chairman of the board and treasurer; **S. O. Beren,** vice president and general manager, president; and **Allen A. Staub,** secretary, general vice president and secretary. Max Beren has spent his entire working life in the oil field supply field. In 1917 when the El Dorado oil pool began attracting wide attention, he brought service to Kansas, opening a supply store in El Dorado, Kansas. Beren, as chairman of the board and treasurer for the concern, will continue to operate from headquarter offices in Parkersburg, W. Va. S. O. (Bud) Beren, son of the company founder, has been vice president and general manager for Misco since 1946. As president, he will continue to operate from the Wichita Misco office. Staub, the new general vice president and secretary who will continue to serve from the Parkersburg office, has a broad background in executive business service and in the oil field supply business. He has been in oil field supply since joining Misco in 1945, in Parkersburg.

•

**Drilco Oil Tools, Inc.,** has recently established a sales office in Houston with **Don Morris** in charge. He has been with Drilco since its organization in 1953 and was formerly district field salesman with the company in West Texas. As Drilco is primarily a manufacturer of drill collars, the Houston office will be chiefly concerned with this phase of the business.

•

**Duff-Norton Company** announced the promotion of **T. W. Krueger** to sales manager of the Jack division. He will be in charge of all railroad, industrial and export jack sales. Krueger moves up from a position as assistant sales manager of


*Congrats and $25 to LOCKWOOD H. POOL, 424 Shell Bldg., New Orleans, La., for this quip.*

"...thinks a female connection is a steady date."

The oil country has a whopping big appetite for pipe. Lone Star Steel's huge plant was built for the specific purpose of supplying fully normalized *API casing, tubing and line pipe* to Joe Roughneck, heart of the oil and gas industry. As fast as we can make it, he gets it!

Now ... we're building again ... our new stretch-reducing mill and another open hearth furnace. Goal: more fine steel and more pipe ... to help Joe meet the greater domestic and export demand for petroleum.

**Neighbor, wherever you are, specify Lone Star and we both get a good deal.**

**Lone Star STEEL COMPANY**

LSS

**EXECUTIVE-SALES OFFICES**
W. Mockingbird Lane at Roper • P. O. Box 12226 • Dallas, Texas

**DISTRICT SALES OFFICES**
Houston, Texas | Midland, Texas | San Antonio, Texas
Tulsa, Oklahoma | Wichita Falls, Texas | Shreveport, La.

Duff-Norton. He joined the company in 1947 as advertising and sales promotion manager. Krueger previously was in the Advertising and Public Relations department at Jones & Laughlin Steel Corporation.

•

**Four Wheel Drive Auto Company** has promoted **Victor M. Anderson** to assistant to the vice president—sales and **Fred A. Brown** and **Robert J. Peterson** to assistant sales managers. **G. F. DeCoursin,** vice president—sales, said the promotions to newly-created positions are part of the Clintonville, (Wis.), firm's expansion of its sales organization. Anderson, with FWD since 1936, has supervised the Clintonville sales office as sales administrator the last four years. He previously functioned in purchasing and field sales capacities. Brown, who will be in charge of district sales managers in FWD's Eastern division, has spent 19 years in the FWD organization, much of the time as a district sales manager in the Midwestern area. Peterson entered the FWD firm earlier this year as a district sales manager in the Northwest, after nine years in truck sales with another company. He will supervise FWD's Western division sales staff. Both Brown and Peterson will work with district sales managers in marketing FWD's four and six-wheel-drive utility, construction, logging, oil field, transport, fire fighting, ready-mix, road maintenance, snow plowing and other heavy-duty trucks.

•

W. H. Riggins

E. M. Hansen

**W. H. Riggins** has been named export sales representative for **Hydril Company.** Riggins will assume his new duties in Hydril's New York office on his return from a trip to Colombia, Venezuela and Trinidad. Background experience for his appointment includes three years as export representative in the Hydril Sales department covering the period from 1946 to 1949. Riggins joined Hydril as a sales engineer in 1938 and has also worked in Engineering and Production Control. During the last five years he has been in charge of drilling and production for Lansekan Company, Inc., a Hydril subsidiary in Kansas.

•

**E. M. Hansen** has been appointed manager of the Petroleum Equipment division of the **Axelson Manufacturing Company,** Division of U. S. Industries, Inc. The Petroleum Equipment division will be set up as an integral operating unit completely separated from the other divisions of the company and will be devoted exclusively to the manufacture of petroleum production equipment. Prior to his promotion, Hansen was manager of the Axelson Sucker Rod plant in St. Louis, Mo. He became associated with the company in 1935 and since that time has held several positions including plant engineer, production manager and assistant plant manager. In addition to his experience with Axelson he was president and treasurer of the Auto Screw Products Company and sales engineer for the Phillips Petroleum Company.

•

**Brown Oil Tool Company** has added two employes to its sales staff and announced two transfers. The new additions are **Fred Procter** who is located at Corpus Christi, Texas. **Joel Little** is stationed in Brown's Oklahoma City store. Both Procter and Little have had considerable oil field experience and have completed a training program at Brown Oil Tool's Houston plant. Recent personnel changes involved the move of **R. C. Buchahan** from New Orleans to Houston as city salesman and **Paul Lawrence** to New Orleans. Lawrence formerly was stationed in Corpus Christi.

•

**Axelson Manufacturing Company,** Division of U. S. Industries, Inc., recently announced the appointment of **D. L. Witzel**


**DESIGNED, TESTED AND PROVEN IN THE OIL FIELDS**

**Screened Air Port**

Unexcelled . . . for Outdoor Use

- DRIP PROOF
- VERMIN PROOF
- MOISTURE PROOF
- CORROSION RESISTANT
- FORCED AIR COOLED

All these features of Fieldmaster Ball Bearing Motors have been designed to overcome the rugged conditions of Oil Field requirements.

**FIELDMASTER**

**CHECK THESE OUTSTANDING ADVANTAGES.**

Heavy Cast base for alignment, stability, heavy duty, double-shielded, prelubricated bearings, reduces lubrication worries, high grade silicon steel in the magnetic circuit reduces iron losses . . . Wide variety of windings provides triple ratings, dual voltages . . . high torque licks heavy starting problems. High slip is available to take care of reciprocating load requirements encountered in pumping.

*Write For Descriptive Literature.*

**BETHLEHEM SUPPLY CO.** TULSA, OKLAHOMA

**Manufactured by VALLEY ELECTRIC CORPORATION, St. Louis, 8, Mo.**

**KING CIRCULATING HEAD AND STRIPPER**

**Type 4-SC Circulating Head and type AR Wire-Line Stripper often used in combination for wire line coring, sidewall coring, sidewall sampling, and well logging.**

**The 4-SC is the first circulating head designed to withstand any considerable rotation, will control highest pressures of deep well drilling.**

**Type 3-AR and 4-AR Strippers are also used separately for swabbing, bailing, etc.**

*KING OIL TOOLS*

P. O. BOX 15146 • 7944 DOCKAL RD. • HOUSTON 20, TEXAS • OR 3-3421

to the position of sales manager California region, petroleum equipment and **L. T. Nave** as special representative in the California division. Witzel has been associated with Axelson since 1935 and has held several executive positions including assistant California sales manager. Nave, who joined Axelson in 1936, will continue his representation in the city of Los Angeles, in addition to assisting the sales manager on export sales.

•

**Frank F. Elliott** has been designated chairman of the board of directors of **Crane Co.** and will be succeeded as president of the company by **Neele E. Stearns,** currently vice president for planning and development of the Inland Steel Company. Elliott, whose career with the Chicago-headquartered manufacturer of valves, plumbing and heating equipment covers a span of 34 years, has been president of the 101-year-old Crane Co. since June 1, 1955. He joined the organization in 1922 as a sales engineer at the company's Los Angeles branch and in 1928 was named sales manager at that location. After filling a similar post at San Francisco, he subsequently served as assistant manager and branch manager there and was named western district manager in 1943. He moved to Chicago as vice president in charge of branches in 1951 and became senior vice president of sales in 1952. Stearns has been with Inland since 1940, when he joined the organization as manager of the Department of Business Procedures. In 1947 he was made assistant general manager of sales, and two years later went to Inland Steel Products Company as executive vice president. Late in 1950 he was elected president of the subsidiary, which manufactures steel building products and consumer items.

Before going to Inland, Stearns was associated for 10 years with A. T. Kearney and Company, management consultant firm. During this period he also served as a faculty member in the school of business at both Northwestern University and the University of Chicago, as well as in the Social Science department at the Illinois Institute of Technology.

•

**Ellis P. Festervan** was appointed field representative at Houston for **United States Steel Corporation's** Oil Well Supply division. Festervan was employed by Oilwell in 1955 at Houston. Prior to his employment by the division he had seven years experience in the oil field supply business.

•

**Fisher Governor Company's** sales representative for Boston and the New England area is **Clarence B. Petty & Company,** 50 Kearney Road, Needham Heights 94, Mass. Other sales engineers that will assist Petty are **Walter Taylor** and Steve **Lord.**

•

**Northern Pacific Railway Company,** announced that **Charles F. Hunkins** has been appointed assistant vice president of the Oil Development department. Hunkins joined the Northern Pacific staff as chief petroleum engineer in 1952, and since 1955, has been manager of geology and engineering.

•

**D. R. Dillehay,** with **Lane-Wells Co.** nearly 20 years and since 1942 Mid-Continent division office and credit manager at Oklahoma City, has been transferred in the same capacity to the Gulf Coast division headquarters in Houston. Dillehay replaces **Paul M. Terrill,** who resigned. **James F. Gregory,** since 1948 Dillehay's assistant in Oklahoma City, has been advanced to the position of Mid-Continent division office and credit manager.

•

**W. Bedford Sharp,** president and chairman of the board of **Mission Manufacturing Company,** has been elected to the board of directors of **Houston Bank & Trust Company.** He served as consultant and adviser to the Petroleum division of the Economic Cooperation Administration (Marshall Plan) in Paris during 1948 and 1949. He is also chairman of the board of Mission Manufacturing Company, Ltd., of England, and of Compania Anonima Maquinaria Petrolera in Venezuela.

Alonzo A. Neese

Walter E. Barnes

**Alonzo A. Neese** has been named chairman of the board of the **Warner Electric Brake & Clutch Company.** He filled the vacancy created by the recent death of **Pierpont J. E. Wood** who had been chair-

**SAVE VALUABLE FIELD TIME WITH ENARDO CLOCKS**

Save time and trips by installing an Enardo Clock Shut-Off Valve.

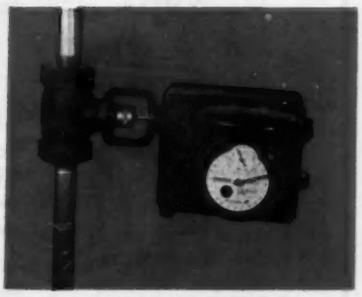
You can soon pay the initial cost of installing the Enardo Clock by saving the return trips necessary to check installations.

The Model "W" Clock is designed to control the flow of low pressure gas or liquid and to shut off the supply at a predetermined time, with a positive bottle tight seal. Valve will function at operating pressures up to 100 p.s.i.

The Enardo "MB" and "A" time cycle switches are designed to control electrical circuits on pumping engines and other equipment. They will shut-down the engine at any number of hours, up to 22 hrs. on the 24 hr. model; and 11 hrs. on the 12 hr. model. All clocks are manually wound and set.

Always look to Enardo for the finest in oil field equipment.

"A" & MB Type Time Cycle Switch



"W" Clock Shut-Off Valve

ENARDO manufacturing co.

BOX 1647 • TULSA, OKLAHOMA




For more data on advertised products, use Readers' Service Cards, last page.

man of the board. Neese is vice president and director of the Beloit Iron Works and vice president of Beloit International Corporation. He has been a director of Warner Electric since last May.

•

**Walter E. Barnes** has been appointed district manager of the newly-created Panhandle district of the Midwest division of **The National Supply Company.** The new district comprises the top 20 counties in the Texas Panhandle, the Oklahoma Panhandle, and sections of western Oklahoma and western Kansas. It includes the company's oil field supply stores at Borger and Pampa, Texas, formerly in the Wichita Falls district of the Southwest division, and at Elk City, Okla., in the Oklahoma City district, and Liberal, Kansas, in the Great Bend district, both in the Midwest division. Barnes started with National Supply in 1945 at Stafford, Kansas, and has served as store manager there and at Elk City, Okla. Since March, 1955, he has been a rotary equipment salesman for the Midwest division. He will have his headquarters at Amarillo, Texas.

•

**C. W. Blount** has been appointed vice president—marketing and **J. D. Benedito** has been appointed vice president—sales of **Bakelite Company**, a division of Union Carbide and Carbon Corporation. Blount joined Bakelite in 1924 as a sales engineer. In 1932 he was appointed assistant sales manager, becoming vice president and general sales manager in 1944. He was made vice president in charge of sales in 1953. Benedito started with Carbide and Carbon Chemicals Company, another division of Union Carbide, as a sales trainee in 1935. In 1942, he was transferred to the Canadian Resins and Chemicals Company as sales manager. He was appointed division sales manager for Bakelite in New York in 1948, becoming general sales manager in 1956.

David W. Wolf

Don B. DeSirey

Joe Ronald Schoeffler

A. M. Birnie

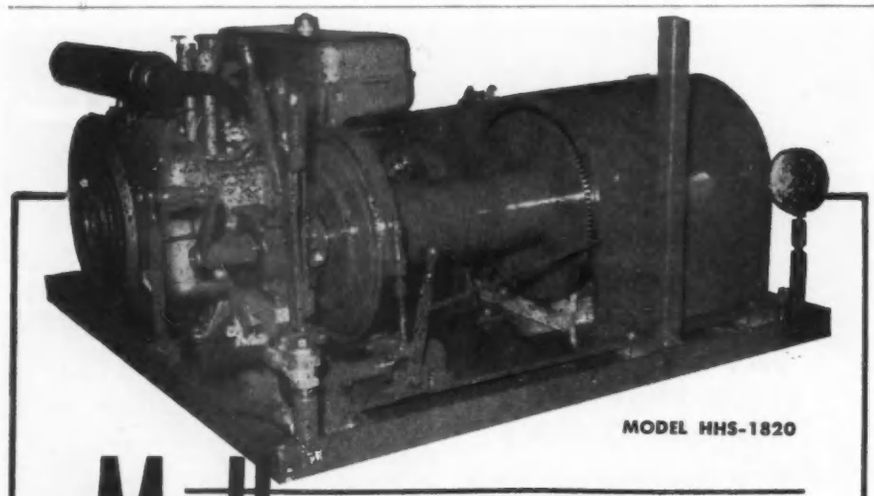
**Orbit Valve Company** has announced three new appointments to the sales staff. **Joe Schoeffler** goes to Houston as industrial sales representative where he will work under the direction of **Ralph H. Soape**, Orbit's district sales manager for the Gulf Coast area. Schoeffler will call on chemical plants, refineries and gasoline plants along the Gulf Coast area. **Don DeSirey** will headquarter in Tulsa where he has been assigned to general sales work in the Tulsa area. **David Wolf** will be Orbit's field representative for southeastern New Mexico with headquarters at Hobbs, where he will work under the direction of **H. C. Sawyer**, Orbit's regional sales manager, Midland, Texas.

•

**A. M. Birnie** was appointed executive vice president for **Security Engineering Division.** Birnie, who was formerly vice president and general sales manager, will continue in his capacity as general sales manager and also assume the responsibility for field engineering activities. Birnie joined Security in 1944 as a field engineer. He was named a district manager in 1945, Mid-Continent manager in 1947 and vice president and general sales manager in 1952.

•

**Eric A. Bianchi** has been appointed vice president in charge of engineering and **Paul Wing, Jr.,** has been promoted to chief engineer of **Mason-Neilan Division of Worthington Corporation.** Bianchi has been a member of the Mason-Neilan organization for 25 years, serving in various sales and engineering capacities, most recently as director of engineering. Wing, a 12-year veteran, was formerly manager of the Product Application Engineering department. In their new positions, Bianchi and Wing will be responsible for the engineering direction on the Mason-Neilan line of control valves, instruments, regulators, automatic controllers, liquid level controllers and associated equipment.

MODEL HHS-1820

Mathey MEASURING LINE REELS

The Oil Industry's First Name in Reeling Equipment
*"Never a Compromise in Quality"*

Mathey Reels are available in many sizes with various drives and controls in combinations to completely meet every requirement. Choose your type of control — hydraulic or mechanical, your capacity, your line speed and pull, and your type of power—hydraulic air, electric or internal combustion engine.

Mathey's many years of experience guarantee you extra heavy duty construction, precision machining, oversize bearings and forged steel drum flanges. Mathey also engineers and manufactures specialty reels to fit your individual requirements.

**USES:**

- Bottom Hole Pressures
- Temperature Surveys
- Calipering
- Paraffin Cutting
- Sampling
- And Many Other Wire Line Jobs

SEE OUR CATALOG IN THE COMPOSITE CATALOG

*Call or Write for Further Information*

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Joe Roughneck stands amid East Texas oil derricks.

## Lone Star Steel Lauds East Texas Oil Industry

Simple and historic ceremonies held in East Texas recently brought into sharp focus the high esteem in which the Southwest holds the oil industry. Occasion for the ceremonies was a program sponsored by Lone Star Steel Company and the East Texas Chamber of Commerce. The program was divided into two parts, the first of which was held at Longview's Pinecrest Country Club.

The luncheon program chairman was L. D. (Red) Webster, vice president of Lone Star. Favors placed at each plate were small bottles of oil. The labels read "Texas Tea: Joe Roughneck's formula—Equal parts of foresight, courage, ambition and effort. Stir with a drill bit and serve to the world." The samples were taken from the Joiner discovery well, compliments of H. L. Hunt, the present owner of the well that triggered the East Texas boom.

Following this portion of the program, the guests boarded chartered busses for a 30-mile ride to Pioneer Park, a roadside parkway developed by Lone Star and deeded to the East Texas Chamber as perpetual monument to the pioneers of the field.

James Aston, president of Republic National Bank, Dallas, set the stage for the unveiling of a monument inside which is a time capsule containing trade journals, newspapers, films, pictures, maps, 100 shares of Lone Star stock etc. This capsule will be opened in 2056 A. D., but in the meantime, Republic Bank will serve as trustee of the fund created by the stock. Income will be used to help East Texas boys and girls obtain college educations.

## Grover Kilgore to Serve As 1957 PESA President

Petroleum Equipment Suppliers Association members elected Grover Kilgore, vice president of Halliburton Oil Well Cementing Co. in Duncan, Okla., as their new president. The annual meeting was held in Palm Springs, Calif., April 6-10.

Other officers are vice president, W. T. Powell, executive vice president of Continental-Emsco in Los Angeles; treasurer, Wharton Weems, of Vinson, Elkins, Weems and Searls law firm; and assistant treasurer, Leroy Jeffers, of the same law firm.

The Eastern district chairman is Paul Scherf. Director emeritus is Ferd J. Spang of Spang & Company, Butler, Penn. Director at large is Mason B. Jones, of The S. M. Jones Company, Toledo, Ohio.

Other Eastern directors are Karl Elliott, Acme Fishing Tool Company; Rainey Elliott, Jones & Laughlin Steel Corp.; Jene Harper, Franklin Supply Co.; Lloyd Lanphere, Ajax Iron Works; Donald W. Mackie, Jr., Bradford Supply Co.; Frederick F. Murray, Oil Well Supply Division, United States Steel Corp., Bernard P. McDonough, Parkersburg Rig & Reel Co.; A. W. McKinney, The National Supply Co.; J. T. Murray, Midway Supply Co.; Paul Scherf, Alten Foundry & Machine Works, Inc.; John G. Seiler, Tube Turns, Division of National Cylinder Gas Co.; and H. Bernard Wehrle, McJunkin Corporation.

John G. Staudt is Mid-Continent & Rocky Mountain district chairman. Guy A. Tompson of Bethlehem Supply Co., Tulsa, is director at large.

Directors are R. A. Baker, Franks Mfg. Corp.; F. E. Bernsen, Lucey Products Corporation; W. L. Butler, W. C. Norris, Manufacturer; Davis D. Bovaird, The Bovaird Supply Co.; Lester W. Hall, Eastman Oil Well Survey Co.; S. J. Iverson, Iverson Supply Co.; Grover Kilgore, Halliburton Oil Well Cementing Co.; K. W. Lineberry, Black, Sivalls & Bryson, Inc.; M. G. McCool, American Iron & Machine Works Co.; John G. Staudt, Dowell Incorporated; S. P. Wallace, Maloney-

Offshore

OIL INSURANCE

Drilling for oil or gas under the sea is just another venture for oil men—with certain additional operating complications, of course; but basically its problems are those of drilling for oil or gas.

**Ever since the beginnings of oil operations in the Gulf, we have worked closely with insurance agents and brokers for the oil industry, designing special forms of insurance to properly protect drilling and production equipment at sea. We have arranged a pool of underwriters who can provide the protection required by new-type structures. Our offshore loss men are experienced in dealing with oil people, and we have a specialized offshore loss prevention facility to help keep insurance costs down and eliminate equipment down-time.**

If your insurance agent or broker has placed your offshore insurance with us you can be assured it is in experienced and specialized hands.

SOUTHERN
MARINE & AVIATION UNDERWRITERS, INC.
NEW ORLEANS

610 Poydras St. Telephone TU 5266

*L. K. GIFFIN, President*
*FRED L. KRIEDT, LEE M. STENTZ, Vice Presidents*

Crawford Tank & Mfg. Co.; and J. E. Webb, Republic Supply Co. The district chairman of the Southwestern district is M. E. Montrose. The three directors at large are Fred M. Mayer of Continental-Emsco, Dallas; M. E. Montrose, Hughes Tool Company, Houston; and Wallace D. Wilson, Wilson Supply Co., Houston.

Directors are H. H. Allen, Cameron Iron Works; Ken W. Davis, Mid-Continent Supply Co.; R. G. Hamaker, Reed Roller Bit Co.; Ott Hammer, Dresser Operations; Frank L. Hereford, Murray-Brooks, Incorporated; Elliott Johnson, Schlumberger Well Surveying Corp.; W. H. Larkin, Larkin Packer Co.; L. A. Little, Lufkin Foundry & Machine Co.; George O'Leary, Houston Oil Field Mtl. Co.; R. H. McLemore, Otis Pressure Control, Inc.; Ray O. Shaffer, Welex Jet Services; and Richard E. White, Mission Manufacturing Co.

W. T. Powell is Pacific district chairman. J. A. Crawford, The Youngstown Steel Products Co., Los Angeles; E. S. Dulin, Byron Jackson Co., Los Angeles; and T. Sutter, Baker Oil Tools, Inc., Los Angeles are the new directors at large.

Directors are James Bere, Axelson Mfg. Co.; Markley C. Brown, Hillman-Kelley; J. L. Evans, The National Supply Co. of California; Don Grubbs, Oil Well Supply Div., United States Steel Corp.; H. J. Hagn, Chiksan Company; Harold E. Howard, Howard Supply Co.; Wendell M. Jones, Bethlehem Supply Co.; John J. Neale, Lane-Wells Company; H. H. Peters, Technical Oil Tool Corp.; John J. Pike, The Republic Supply Co.; of California; W. T. Powell, Continental-Emsco Co.; and W. A. Wilson, Web Wilson Oil Tools, Inc.


# DRILLMASTER 300 P.A. ROTARY DRILL

## QUICKER DRILLING/ NO FLOODING/

The Drillmaster Power-Arm Drill represents an advanced approach to the truck/trailer mounted prospecting drill problem. The rotation of the drill pipe and bit is by means of motors mounted in a gear box at the upper end of the drill string. The rotary head, as this gear box is called, is moved up and down with the drill string by means of an arm which is pivoted at its front end.

The arm, and thus the rotary head which is mounted at the rear of the arm, is raised and lowered by jacks mounted a short distance to the rear of the arm front pivot point. In order that the rotary head shall travel up and down on a vertical straight line, a system of links is attached towards the front end of the arm, and to the front frame (about the top end of which the front end of the arm pivots); these links move the front pivot point of the arm forwards and rearwards thus maintaining the position of the rotary head above a fixed point. The system of links is a modified form of the well known "Scott-Russell" straight line motion and causes the rotary head to travel on a vertical straight line over the length of movement permitted by the jacks.

A guide mounted vertically under the rotary head, and a short distance above the ground, holds the first length of drill pipe, and the bit, vertically and prevents the turning bit from wandering at the commencement of the hole. As drilling progresses the guide serves to reduce whip in the drill string and so assists in maintaining the drilling of a straight hole. Send for illustrated bulletin.

**HANDS-ENGLAND OILFIELD EQUIPMENT LTD**

MANUFACTURERS OF GEOPHYSICAL SUPPLIES

LETCHWORTH HERTS ENGLAND TEL: 600 CABLES: OIL LETCHWORTH ENGLAND

Stuart Durant

Derrill Taylor

## Taylor and Durant Named Representatives for Win-Well

Two new firms have been added to the list of sales representatives for Win-Well Manufacturing Co. of Los Angeles. They are Robert Taylor & Sons of Salt Lake City, Utah, and Durant & Associates of Casper, Wyo.

Robert Taylor & Sons is headed by La Mar Taylor, who serves as general manager. His partner in the company is his brother, R. Derrill Taylor, with extensive experience in refinery, pipe line and industrial equipment fields. The Taylor Company will represent Win-Well in Utah, eastern Nevada, Idaho, western Montana, western Wyoming, western Colorado and northwestern New Mexico.

Stuart J. Durant, owner of Durant & Associates, has been generally engaged in control engineering, systems and equipment, contract installations and construction in the Rocky Mountain area for the past four years. The Durant organization will handle sales and service for Win-Well in eastern Montana, eastern Wyoming, Colorado east of the Divide, the Western third of North and South Dakota and Nebraska.

## Dowell Opens Sales Office In Denver; Nielsen to Head

Dowell Incorporated opened a general sales office in Denver last February. The new sales office will be in Denver's center building where Dowell also maintains a district office.

E. H. Neilsen, formerly manager of Dowell's Denver district, will head up the new office with title of general sales engineer. Nielsen joined Dowell at Great Bend, Kansas, in 1944. In 1950 he was transferred to the company's general sales office in Tulsa where he remained until he moved to Denver in 1952. A year later he became manager of the Denver district, a position he held until his recent transfer. Nielsen's territory will include the Rocky Mountain states and western Canada.

Nielsen has been succeeded by Earl H. Davis as manager of Dowell's Denver district. Davis joined Dowell at Great Bend, Kansas, in 1948. He was transferred to the company's general office Sales department in Tulsa at the same time Nielsen went to Tulsa. Late in 1953 Davis became area manager in Dowell's Salem, Ill., district. Since October, 1955, Davis has been in Tulsa as assistant to the general manager of the company.

## Standard Tube Installs Facilities To Make Scarce Tubing Sizes

The Standard Tube Company recently completed facilities for the manufacture of oil country tubular goods in Detroit. The company expects to produce tubing sizes that have been consistently in short supply, particularly 2⅜-inch 4.7 lb./ft.

EUE threaded and coupled tubing, J-55. Plain end pressure tubing in one-inch, 1¼, and 1½-inch sizes, normally used in dual and triple completions will be manufactured, also. Limited amounts of 4½-inch O. D. 9.5 lb./ft. threaded and coupled casing will also be made. New facilities, including upsetting, threading, and testing equipment, have been installed to permit the manufacture of casing as large as 5½-inch, 14 lb./ft.

Standard Tube has produced electric welded mechanical tubing, including heat exchanger and boiler tubing and other similar products, for many years.

James E. Stough

John W. Jordan Jr.

## Welex Jet Services Opens Shreveport District Office

Welex Jet Services, Inc., has opened a new district office in Shreveport, La., to offer the company's full line of jet perforating and associated services to the northern Louisiana, East Texas and southern Arkansas area.

James E. Stough is manager of the new district office and operating branch. Stough moved to the new area from the company's Beaumont district where he had been manager. He has been with Welex the past seven years in managerial positions and has spent more than 13 years in oil well service work.

Assistant manager of the new district is John W. Jordan, Jr., who moved to Shreveport from Odessa, Texas, where he had been a sales engineer. Jordan has spent the last four years in oil field work, the past three with Welex.

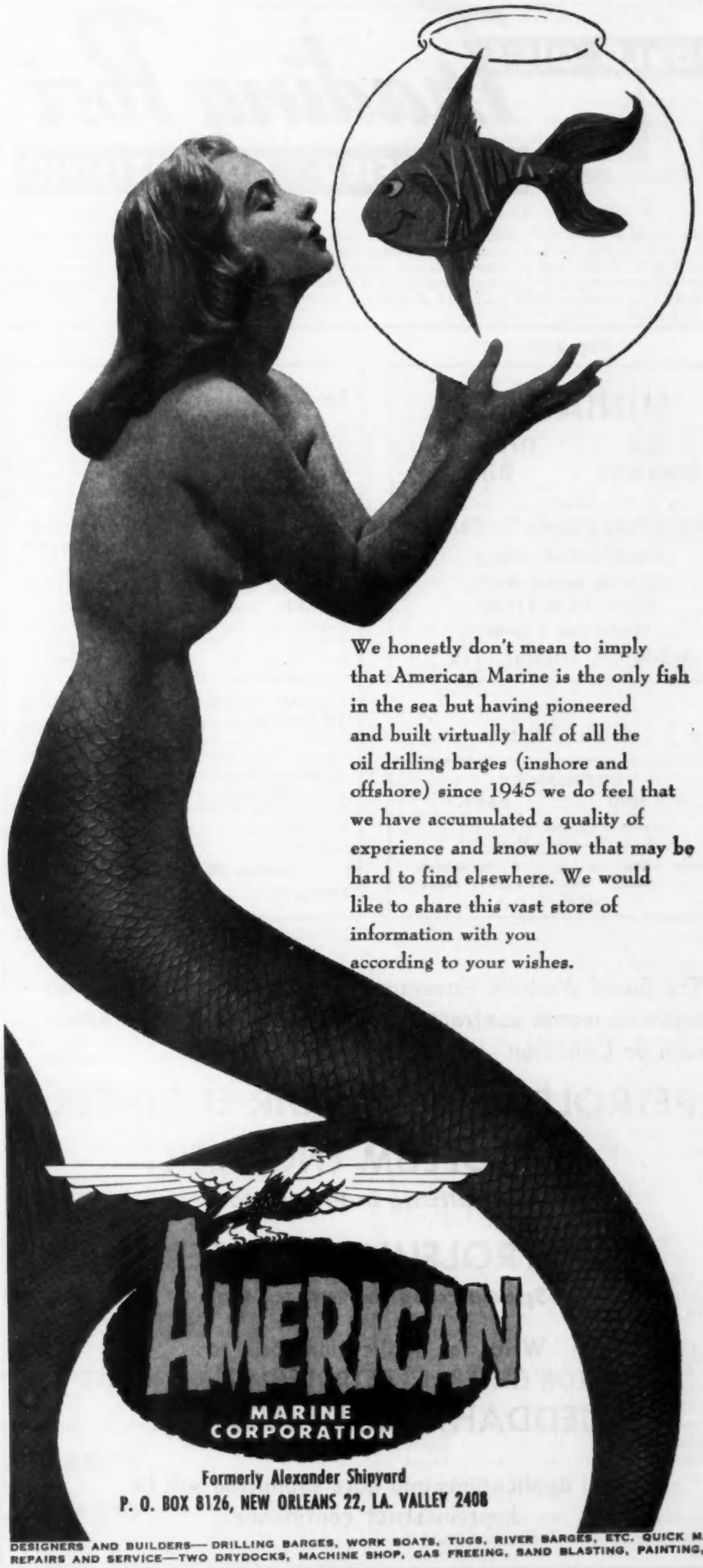
## Jet-Lube Grants A.B.C. Coupler English Manufacturing License

Jet-Lube, Inc., has granted a manufacturing license to A.B.C. Coupler & Engineering Co., Ltd., of London, for the manufacture of Jet-Lube's tool joint and pipe thread compounds and its extreme-service greases and oils.

Jet-Lube Limited (England) has been formed with principal sales and executive offices at 26 Caxton Street, Westminster, London, S.W.-1. Manufacturing works are now being erected at Wolverhampton, England.

The new English company will manufacture the entire line of Jet-Lube tool joint and thread compounds. The API approved formula thread compounds will also be manufactured. The English products will be manufactured to the same specifications as the American products. The same procedures will be used to assure uniformity and exact quality as made in America.

Frank E. Bergeron, vice president and general manager of Jet-Lube, Inc., will supervise installation of machinery and the initial production at the Wolverhampton plant.



We honestly don't mean to imply that American Marine is the only fish in the sea but having pioneered and built virtually half of all the oil drilling barges (inshore and offshore) since 1945 we do feel that we have accumulated a quality of experience and know how that may be hard to find elsewhere. We would like to share this vast store of information with you according to your wishes.
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DESIGNERS AND BUILDERS— DRILLING BARGES, WORK BOATS, TUGS, RIVER BARGES, ETC. QUICK MARINE REPAIRS AND SERVICE—TWO DRYDOCKS, MACHINE SHOP, GAS FREEING, SAND BLASTING, PAINTING, ETC.




For more data on advertised products, use Readers' Service Cards, last page.

# WORLD OIL'S Trading Post
## CLASSIFIED ADVERTISING

**RATES: Regular Classified** (undisplayed) **set in this size type: 20 cents per word. Minimum charge $4.** Blind box address in our care counts six words. Replies forwarded without charge. **Display Classified ads,** set in suitably larger type with ruled border. **$13.50 per column inch. Ten percent discount for two or more insertions of same copy in consecutive issues. All classified ads payable in advance.** Send copy and checks to: Trading Post Classified Section. World Oil, P. O. Box 2608, Houston, Texas.

### FOR SALE

**MINIATURE**
**Oil Derricks** **Drilling Bits**
For
Watch Fobs-Charms-Tie Chains
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**GOLD OR NICKEL PLATED**
**Prices: $7.00-$15.00**
Write Box 125-W
World Oil, Houston, Tex.

### MISCELLANEOUS

**VENEZUELAN OIL SCOUTING AGENCY**
Periodic operations reports (industry-wide)—Maps—Newsletter
Cables: VOSA, Caracas, N. R. VanMiddlesworth Airmail: Apartado 3963 Phone: 54 48 02

### FOR SALE

For Sale:

**3-T D-7 CATERPILLAR TRACTOR** equipped with Cat. hyd. bulldozer, Hyster towing winch, oil clutch, 20 in. tracks, crankcase guard, pull hook, electric starter on starting motor, lights, will sell without winch; perfect condition used only 1200 hours. Price $16,000.00, no down payment, pay for by the month.

**H-D9X ALLIS CHALMERS BULLDOZER** equipped with crankcase guard, pull hook, and Carco model F towing winch, used 2000 hours, perfect condition. Will sell without winch, price $7,000.00. Pay for by the month.

**LJSW MACK TANDEM TRUCK TRACTOR** equipped with #70 Tulsa winch, 36 in. 5th. wheel, rolling tail board, 707A engine, air brakes and 26 ft. Montgomery tandem oilfield trailer, very clean unit, will sell for $10,000.00 and include a State wide oilfield hauling authority for the State of Illinois, pay for by the month.

**Contact TOMMY H. PAYNE**
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The Saudi Arabian Government is open to engage on an eighteen month contract fully qualified and mature American or Canadian

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Write for application form to:
DIRECTOR GENERAL - PETROLEUM & MINERALS
**JEDDAH, SAUDI ARABIA**

All applications and data submitted will be kept in strict confidence.

### POSITION WANTED

■ No Degree, 11 years experience in production. Past four as Production & Drilling Foreman. Can read blueprints and do pipefitting. Available April 1, 1957 anywhere. Raymond Ott, Box 402, Robert Lee, Texas, Phone, Globe 3-3351.

### HELP WANTED

**POSITION OFFERED**

**Seismograph Technician** fully conversant with recent developments and interpretation, 8-10 years' field practice, wanted to assume responsibilities of supervision and interpretation at headquarters of French oil company in Algiers. Furnish full information on education, experience. Box 128-W, World Oil, Houston, Texas.

**ADMINISTRATIVE POSITION**
**Independent California Oil Company**

Excellent opportunity for qualified man under 50 years, with an independent integrated California oil company. Man must have oil experience and full knowledge of accounting, tax and financial matters. To start would assist and work with Vice President and other officers with good opportunities for advancement. Should have C.P.A. certificate and be capable of financial planning and budget work and able to assist executives at meetings. Must possess ability to carry out various types of high level assignments. Salary commensurate with experience and ability.

Write to Dept. 24, P. O. Box 226, Church Street Station, New York 8, N. Y.

Petroleum Engineer with Master's Degree, or Doctor's in Chemical, Mechanical, or Petroleum Engineering, for research and teaching in Petroleum Production Engineering at rapidly growing Southwestern institution. Rank and salary open, twelve months employment possible, consulting work encouraged and available in immediate area. Applications will be kept confidential. Box No. 124-W, WORLD OIL, Houston, Texas.

### BUSINESS SERVICE

■ **Delaware Corporations formed and serviced. Inquire without obligation. American Guaranty & Trust Company, 910 West Street, Wilmington, Delaware.**

Well organized, well established oil-well drilling contractor desires the management and supervision of oil properties in West Texas, Central Texas, and New Mexico. Can provide complete handling of oil properties from acquisition to production. No properties too small, and none too large to handle. Inquiries from independents, groups, small or medium sized oil companies invited. Write, wire or call collect for further information.

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**Hobbs, New Mexico**
**Phone: EXpress 3-3141**

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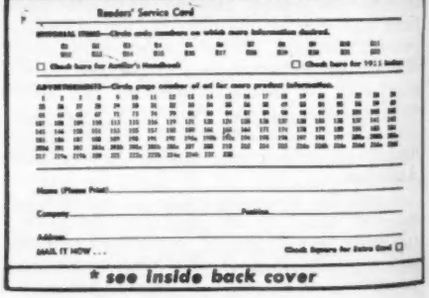
Readers' Service Card

* see inside back cover

### Visco Products to Construct Chemical Plant in Sugar Land

Plans for the construction of a new million dollar plant to produce oil industry chemicals have been announced by Visco Products Company, a unit of National Aluminate Corporation.

The new facility will be located at Sugar Land, Texas, adjacent to Visco's plant No. 1. Construction will begin as soon as practicable according to J. A. Holmes, president of both Nalco and Visco. The tentative schedule calls for completion about Jan. 1, 1958. Manufacturing operations in the new plant will be as automatic as possible to assure best quality control and high production capacity at lowest unit cost. Some older portions of the present plant will be converted to warehouse area when the new facility is in operation.

Crude oil emulsion breakers, refinery desalting chemicals and oil production anti-corrosion chemicals, Visco's three principal product lines, will all be manufactured in the new plant. The company will continue to produce oxyalkylation products and certain specialized chemicals in the existing plant.

### S & R Tool Completes Addition To Houston Plant Facilities

S & R Tool & Supply Company, Houston, which specializes in fabricating, unitizing, machining and repairing oil field equipment, has just completed an 11,000 square foot addition to its plant facilities. This separate building is being utilized for materials storage and layout shop where materials are cut ready for assembly in the main shop. This gives S & R in excess of 55,000 square feet of plant space.


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Detection and location through radiation.
Oil, Gas, Water, Minerals.
Exclusive Agent for German Strahlen "Cymoscope".
Geochemical Soil Analysis.
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**Taft Building, 1680 N. Vine St., Hollywood 28, Calif.**

**REAL ESTATE FOR SALE**

## LARGE MONTANA RANCH FOR SALE

35,273 acre cattle ranch in North Central Montana between Helena and Great Falls, of which 31,240 acres are patented and 4,034 acres leased state land. The entire ranch is admirably located as to modern highways and railroad service.

A beautiful ranch in beautiful country noted for its high quality grasses. The entire ranch is exceptionally well watered with rivers, creeks, and numerous springs. In this exceptionally dry year, no pasture was idle for lack of water.

Modern irrigation system recently overhauled and protected by ample water rights.

Well fenced, good buildings, modern machine shop, excellent corrals, scales and everything required for first class cattle operations.

Three modern dwellings served by natural gas and commercial power, daily mail, school bus and telephone.

Hay production 1,100 to 1,600 tons and developments now under way will further increase hay production. Capacity 2,400 animal units without over grazing. An excellently balanced ranch, now in full operation.

Property will be priced per acre of deeded land which would include all water rights and improvements, with the understanding that all leases will be assigned if the deeded land is purchased.

Machinery, equipment and livestock will be separate negotiations.

All but 2% of the oil and mineral rights are reserved to the sellers.

**IF INTERESTED COMMUNICATE WITH—**

**EDWIN N. HARDY**

**Hereford, Arizona**


### Western and Chemical Process Combine Perforation Services

The Western Company and Chemical Process, a division of BJ Service, Inc. have entered into a cross-licensing agreement on the new perforation sealing process for oil well fracturing and acidizing. This announcement was made jointly by John B. Merritt, executive vice president and general manager of BJ Service, and H. E. Childs, Jr., president of The Western Company.

Perforation sealing is a new process which controls fluid flow and provides one-stage acidizing or fracturing. Savings of 50 percent or more have been realized in certain field operations performed to date.

Under the terms of the agreement, BJ Service will be responsible for licensing other oil well service companies to perform these perforation sealing processes using the combined patent rights and technical development of both Western and BJ Service. The Western Company will be primarily responsible for research and development of the improved equipment and techniques. Both companies will continue to offer the service through their established field outlets, Western identifying their service as "Perforation Ball Sealers" and BJ Service-Chemical Process using the trade name "Select-O-Ball." Licensees of the process will be free to adopt their own trade names.

The patented method uses small diameter balls or other free-floating valves which are injected into the fracturing or acidizing fluid being pumped into perforated pay zones. Since the first fluid enters and treats the most permeable zones, these floating valves are automatically drawn to perforations opposite these already treated zones, seating on these perforations and shutting off additional, unnecessary treatment. Treating fluid is then diverted and concentrated at higher pressures against tighter, harder-to-treat zones.

Major benefits resulting from the new perforation sealing method include:

(1) One-stage treatment regardless of length of zone or distance between perforated intervals, including "dual completion" jobs.

(2) Opening of drainage channels that could not be penetrated by any other method.

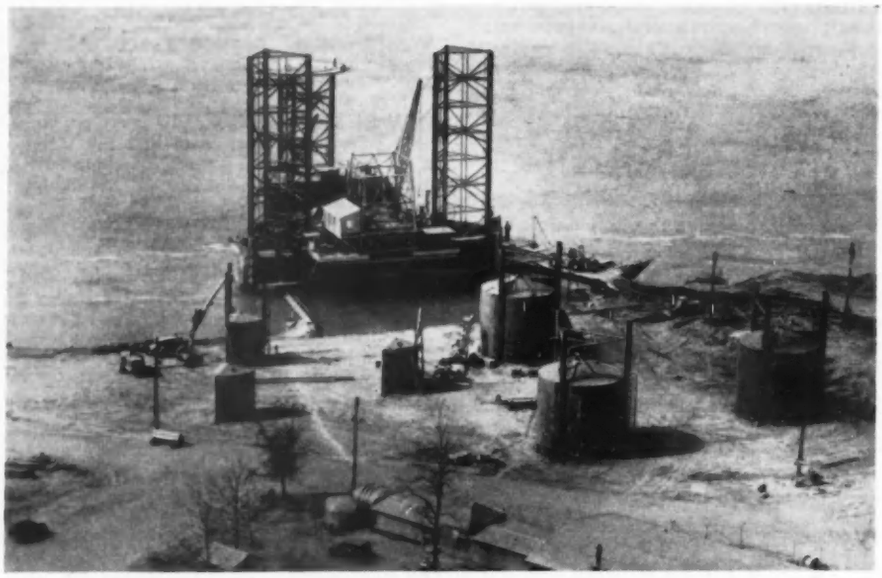
(3) Savings up to 50 percent or more due to one-stage treatment which reduces treating costs, saves rig time, does away with drill-out operations and eliminates costs of packers and bridging plugs.

### Lafayette Grant Oil Tool Builds Expanded Facilities

In a move to increase service facilities in the growing Gulf Coast area, Grant Oil Tool Company and its affiliate, MacClatchie Manufacturing Company, have completed new, expanded quarters at Lafayette, La.

The modern, streamlined building houses the shop, a warehouse and the offices. A full line of Grant and MacClatchie drilling and production equipment is stocked. Around-the-clock service is offered to meet all oil field needs. This branch complements other established Gulf Coast facilities in Harvey, La., and Houston.

B. R. (Ray) Fairchild continues as manager of the Grant-MacClatchie Lafayette branch.



### *One in the Water and Three to Go*

**This aerial view of R. G. LeTourneau, Inc., construction area near Vicksburg, Miss., shows one offshore platform nearing completion in the Mississippi River, and the giant tank-like "feet" of two others just begun. The platform in the water is nearing completion for delivery to Zapata Offshore Company. The three smaller "feet" at the left will go into a compact medium-depth platform ordered by Deepwater Exploration Company. Giant tanks at right are for heavy-duty unit for Barnwell Offshore, Inc. Production line methods plus company's own electric steel mill will permit nine-month delivery or less for future platforms. Those just begun will be delivered this year.**

### New Actinium Neutron Source Goes to Lane-Wells Company

A plan to incorporate the new actinium neutron source developed recently by Well Surveys, Inc., Tulsa, into the neutron logging instruments of Lane-Wells Company was announced by James D. Hughes, Lane-Wells' vice president of sales and service. Both companies are Dresser Industries' organizations.

The actinium source is advantageous in neutron logging because it emits a high neutron flux with a relatively small gamma ray emission. In currently available logging instruments throughout the industry, difficulty exists in emitting neutrons without gamma rays. The commonest type source, a radium-beryllium salts mixture, emits about 10,000 gamma rays for every neutron. Because radio-activity logging detectors may respond to various emissions, this can result in certain inaccuracies. The new actinium-beryllium source, with its small gamma ray emission will correct this difficulty.

•

### Diesel Plant Installed on Gus II By Stewart & Stevenson, Inc.

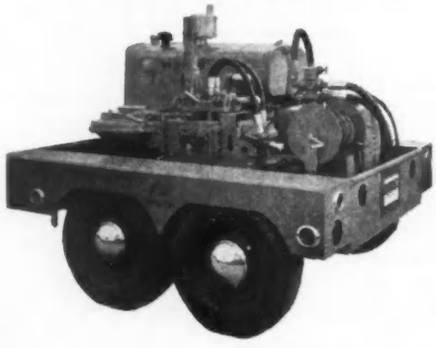
A powerful Diesel electric power plant (6000 maximum horsepower) is being assembled in Houston by Stewart & Stevenson Services, Inc., for placement on a giant mobile platform designed for deep water operations. In terms of horsepower or Kilowatt output, the Rigelectric power packages which will supply power for the entire drilling operation are sufficient to satisfy the normal domestic requirements of an average city of over 30,000 people.

The Stewart & Stevenson Rigelectric units will be installed soon on the "Mr. Gus II" a mobile platform being built in Beaumont, Texas, by the Bethlehem Shipyard for the C. G. Glasscock Drilling Company of Corpus Christi, Texas. The new Mr. Gus II will be capable of probing for oil and gas in approximately 140 feet of water.

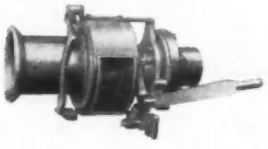
The primary power for Mr. Gus II will consist of five Stewart & Stevenson Model S24-1000 Rigelectric power packages, each of which is composed of two 600 hp D. C. generators and four Model 6-110 Motors Detroit Diesel engines.


TUBING TONG

SPEED with SAFETY



CATHEADS FOR EVERY NEED



Foster BUILDS BEST to OUTPERFORM THE REST

Foster Cathead Company devotes full time and attention to the designing and building of finer equipment for the spinning and breakout of pipe. Foster Catheads and Foster Tubing Tongs are the result of our 31 years in this field exclusively. It will pay you to investigate the performance, endurance, economy, and safety that make Foster products, since 1926, "first choice of the industry."

*All Foster Representatives carry a complete inventory of spare parts for tongs and all models of Foster Catheads*

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*— inshore and offshore*

The Whitney offers facilities for financing exploration, crude oil production, refining and marketing of oil and gas resources.

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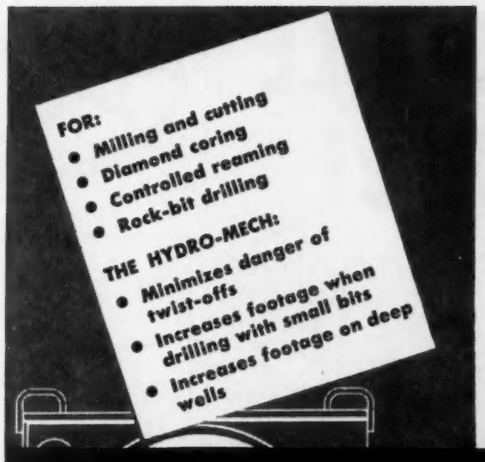
*Established 1883*

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

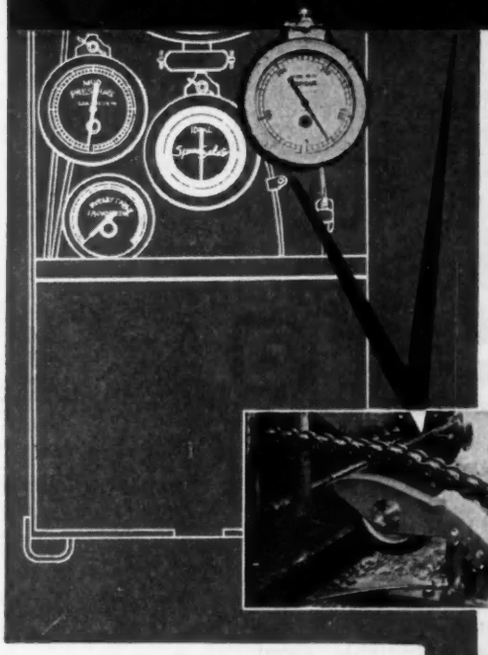



*Easily installed on any chain-driven rotary.*

*Responds to the slightest torque changes.*

*Adjustable for net-torque-on-bottom.*

## WHY MANY OPERATORS DEMAND HYDRO-MECHS ON ALL THEIR RIGS



*Easy to move from well to well.*

*Stabilizes chain and gives it longer life.*

*Models for single or double-link chains.*

*The Hydro-Mech idler assembly rides under the rotary chain and transmits hydraulic impulses to a gauge in the drilling-control panel or in any other convenient spot.*

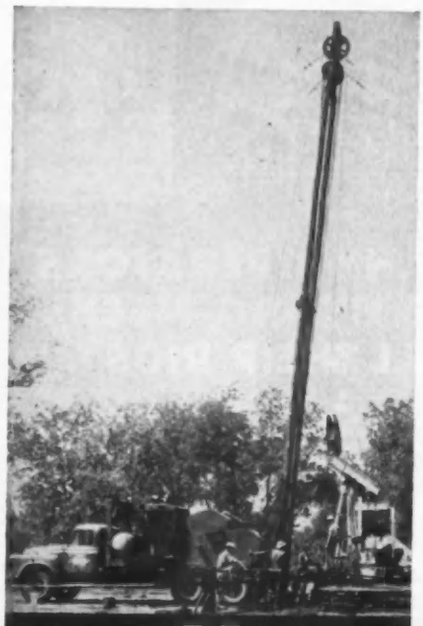
Torque is one of the most important variables in any drilling operation — with too little, you're wasting men and equipment; with too much, you're courting an expensive twist-off. Recognizing these pitfalls, more and more contractors and operators are demanding that their rigs be equipped with Hydro-Mech torque gauges. Compared to a $10,000 fishing job, the cost of a Hydro-Mech is certainly negligible.

**Distributed through Reed, National, and other recognized supply houses.**

**MARTIN-DECKER CORP.**

HOME OF THE WEIGHT INDICATOR — LONG BEACH, CALIFORNIA

# TROUBLE FREE!



WICHTEX
Well Servicing Units

Wichtex units are outstandingly trouble-free. They require a minimum of routine maintenance, and are unequalled for long service without overhaul. These units are real profit-builders, combining both: economy of operation and upkeep, plus unbeatable speed and efficiency on the job. Men who own and operate them "swear by them." Models range from 2,000′ to 12,000′ capacity; all models can be furnished with spudding attachment. Write for catalog.

We also build Portable Rotary Rigs—wheel mounted with draw works built into mast, or skid mounted—models from 2,000′ to 5,000′.

WICHTEX MACHINERY COMPANY INC.
WICHITA FALLS TEXAS
Box 2250 Ph. 2-8612

# SQUEAKS from the BULLWHEEL

WORLD OIL

"I've purchased more stock in this company and demand better consideration of my requests in the future."

### Traveler's Aid

A spry gentleman of 92 traveled by air when he went to visit his widely scattered children. On one trip his son met him at the airport and, surprised to see the old man carrying a cane, exclaimed:

"Dad, I didn't know you needed a cane now."

"I don't," he said with a sly wink, "but I get more attention from the hostess this way!"

### President Material

A group of kids held an election. Some grownups were astonished that a four-year-old had been elected president.

"That boy must be a born leader," said one dad. "How come all you bigger lads voted for him?"

"Well, you see, Dad," Johnny replied, "he can't very well be secretary because he doesn't know how to write. He wouldn't do for treasurer because he can't count. He would never do for sergeant-at-arms, because he's too little to throw anybody out. If we didn't choose him for anything, he'd feel bad. So we made him president."

### Favorite Child

An enthusiastic golfer came home to dinner. During the meal his wife said, "Junior tells me he caddied for you this afternoon."

"Well, what do you know," said the husband, "I thought I had seen that kid somewhere."

### Wrong View

A man telephoned the police to report that thieves had been at work on his car.

"They've stolen the steering wheel, the brake pedal, the accelerator, the clutch pedal and the dashboard," he complained.

A police sergeant said he would investigate. Then the phone rang again.

"Don't bother," said the same voice—this time with a hiccup. "I got into the back seat by mistake."

### Car Trouble?

An MG stalled on the Gulf Freeway in Houston during heavy traffic. As the driver sat waiting for help, a large diesel truck pulled up and stopped. Leaning out of the window, the truck driver shouted, "Hey Buddy, need a new flint?"

### Mother's Plight

Think how a mother kangaroo must feel on a rainy day when the kids can't play outside.

### The Bureaucrat's Dictionary

"A Survey Is Being Made of This"—We need more time to think of an answer.

"Under Active Consideration"—We're looking in the files for it.

"Coordinator"—A guy who has a desk between two expediters.

### One Last Chance

Mr. Smith staggered in wild-eyed. "I shall have to sack that chauffeur of mine," he gasped. "This is the third time this week that he nearly killed me."

"Oh, my dear," soothed his wife, "just give him one more chance."

### Some Binocular!

Blondie: "I enjoyed the opera last night with Bill; he had the most powerful binoculars."

Brunettie: "I'd love to meet him. I just love those strong virile men."

### Occupational Deferment

"We would be pleased," wrote the firm to the Selective Service Board, "if you could assist us in retaining this man a little longer. He is the only man left in the firm, and is carrying on with 15 girls."

### History Repeats

A mountain moonshiner was keenly embarrassed as he encountered the sheriff while lugging a jug to town . . .

When the sheriff showed keen interest in the contents, the owner insisted it was "just good ole mountain spring water" he was taking to a sick friend . . .

The suspicious sheriff insisted upon a sample and when he got through coughing he said, "Y'all call that spring water, Ezry? . . . Jest taste it! . . ."

The mountaineer took a good, long pull and when he got through coughing, remarked: "Well, I swan to man, sheriff, the good Lord's gone and done it again!"

### Loan Sharks

Seems that when girls are short of money there are always some men willing to make advances.

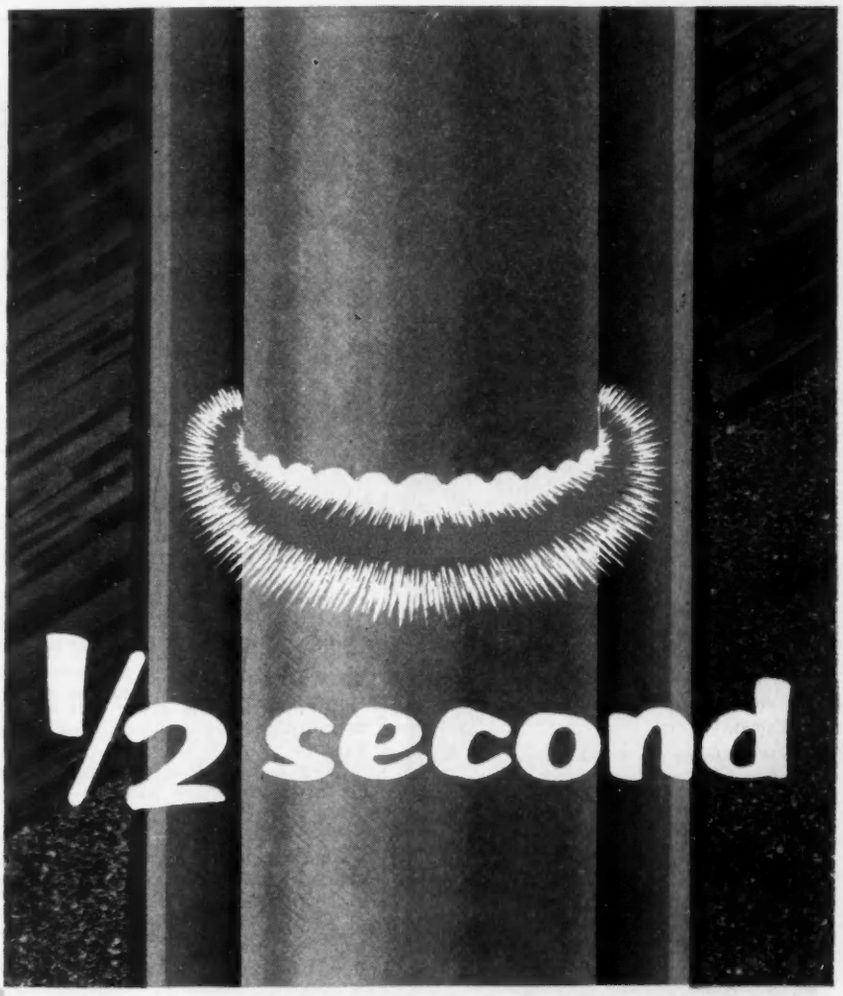
### Famous Last Words

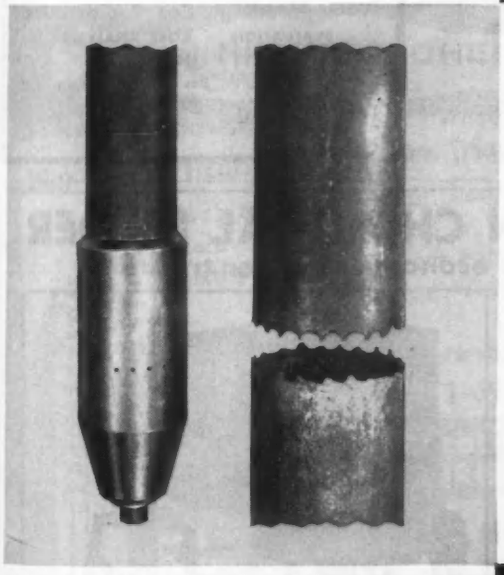
A tourist went into a dimly lit bar in South Africa. Next to him on a stool sat a perfectly formed man in a military uniform—only six inches high.

The tourist stared incredulously, until the bartender said, "Don't you know the Myjor, sir?" and reached across the bar to pick the little fellow up.

The tourist shook his head.

# Cuts Tubing in ½ second





*Above, left*—cutter head of the McCullough Chemical Tubing Cutter showing the orifices from which the chemical is ejected under enormous pressure, cutting the tubing in a fraction of a second.
*Above, right*—sample of 2½" tubing cut by Chemical Cutter. Note the absence of flare, burrs, or distortion of any kind on either the O. D. or I. D.

## McCULLOUGH CHEMICAL CUTTER

This "split-second" Chemical Tubing Cutter applies the enormous power of the halogen fluorides, under closely controlled conditions, to cut through tubing in only ½ second. It will save more than 80% of the rig time usually required to cut tubing by mechanical methods.

McCullough's Chemical Tubing Cutter, run on an electric wire line, makes a clean, flare-free cut. It will not damage the casing even though the tubing be as close as 1/64". The entire operation is junk-free, since no part of the cutter is expendable.

This revolutionary new service will gain you a substantial saving in both time and money on that next tubing job—ask your McCullough Service Engineer. Available for 2" and 2½" tubing at all McCullough Service Locations.

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For more data on advertised products, use Readers' Service Cards, last page.

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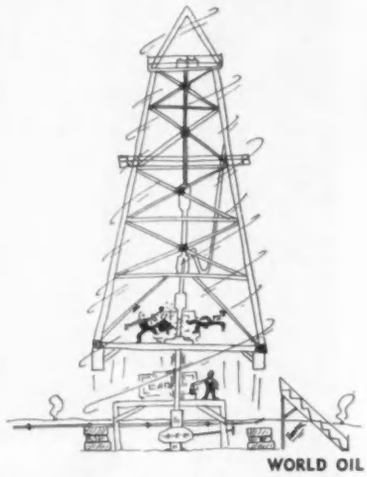

WORLD OIL

"I just know we're gonna get stUCK!"

"Speak up, Myjor," said the bartender. "Tell the damn Yank about the time you called the witch doctor a bloody fool."

### You Dreamer!

"I'm anxious to make this shot, that's my mother-in-law on the clubhouse porch."

"Don't be a fool, you could never hit her at two hundred yards."

### Car Care

One nice thing about sport cars: If you flood the carburetor, you can just put the car over your shoulder and burp it.

### Chief Mourner

A Hollywood actress who said she was in mourning for her third husband insisted on black olives in her martinis.

### Real Living

The life of a housewife is hard;
There are hundreds of things to annoy her,
But what other job can she get
On which she can sass her employer?

### The Hungry Prayer

It wasn't exactly that the 7-year-old disliked going to church; his chief objection was the long pastoral prayer.

So he was naturally apprehensive when his father asked the visiting minister to say grace at dinner. But the prayer was brief and to the point. In pleased surprise the youngster looked up and observed: "You don't pray so long when you're hungry, do you?"

### Visual Answer

Financial Wizard: "Where in heaven's name does all that grocery money go that I give you?"

Wife: "Stand sidewise and look in the mirror!"

### Be Practical

Awakening in the middle of the night to see the shadowy figure of an intruder going through her jewel box, Mrs. Porter aroused her husband and excitedly whispered, "There's a burglar after my jewelry. Stop him."

"Stop him?" choked the apprehensive Mr. Porter. "Suppose he's armed?"

"Don't be silly," implored the worried spouse. "You're insured—the jewelry's not."

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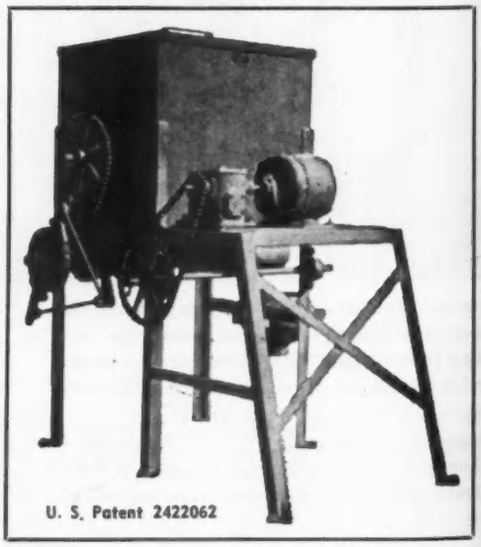
For complete description see Page 2777 of the Composite Catalog.



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**GOTKOOL Water Cooler** — made in 1½-, 2-, 3-, 5-, 10-, 15-, and 20-gallon sizes with either extended or recessed, flush-mounted faucet. *Note:* 15- and 20-gallon sizes available with extended faucet only.

**GOTKOOL Water Can** — made in 1½-, 2-, 3-, 5-, 10-, 15-, and 20-gallon sizes without faucet.

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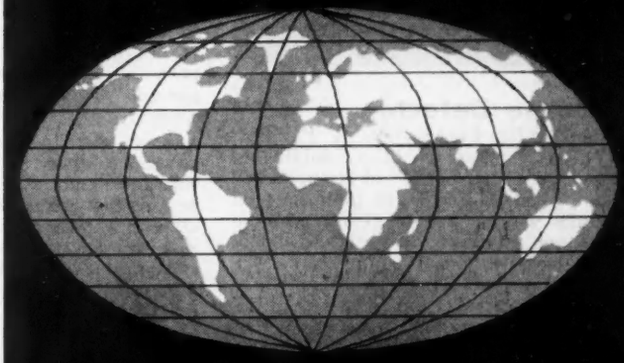

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# What's New In Equipment

**Drilling • Production • Exploration**

## Air-Borne Detector

Aero Service Corporation of Philadelphia, Penn., advises of the availability of a new helicopter-borne electromagnetic detector which should be of interest to oil companies wishing to explore for minerals such as iron, uranium, and copper, in addition to hydrocarbons.

Installation and development of three instruments—an electromagnetic detector, scintillation counter, and magnetometer in the Sikorsky S-55 helicopter was jointly developed by Aero Service and the Geophysical department of Newmont Mining Corporation, New York City. Radio altimeter and a wide angle lens camera are also included in the new airborne EM gear. All signals from these instruments are recorded on a single chart, facilitating on-the-spot interpretation. All instruments are mounted on the aircraft, eliminating the hazards and difficulties of a trailing "bird" and leaving the copter's maneuverability unimpaired.

Vertical coaxial coils used for the EM detector are mounted on booms fore and aft. Response or secondary field resulting from conducting bodies is recorded as in-phase and out-of-phase components. The equipment used in this significant advance in airborne geophysics is sufficiently automatic that an operator is not required, periodic checks by the navigator being enough to insure that it is functioning properly.

Aero officials stressed that the primary advantage of the new device is in exploration for metallic minerals. The helicopter at present cannot accomplish reconnaissance oil exploration that cannot be done just as well and with greater speed by conventional aircraft. But as the science of micromagnetics progresses, it is likely that the helicopter-borne magnetometer will be used to detail reconnaissance magnetometer oil prospects in hilly, remote and mountainous areas.

For more data, circle **No. E1** on Readers' Service Card, last page this issue.

## Diaphragm Control Valves

Black, Sivalls & Bryson, Inc., introduces an entirely new line of diaphragm control valves, the "Super 70 Series," which includes a new topworks, redesigned valve body and an all-metal float ring seal.

The topworks features a new moulded diaphragm for uniform thrust over full valve travel, pressed steel cases for maximum strength with minimum weight, and a precision-calibrated single spring. The entire topworks is iridited and cadmium plated for corrosion resistance. Topworks is available in direct or reverse acting styles and in four sizes.

The valve bodies feature new streamlined flow contours for greater stability, new top and bottom guided inner valves for more exacting flow characteristics, new all-metal float ring seal which provides self-actuating closure and tightens with application of pressure, new forged clamp ring that allows yoke orientation to any position, and bolted stuffing box with stainless steel followers. Valve bodies are available in three styles—single port, double port and split body for use in erosive or corrosive fluid service where easy removability of valve seat is desirable. All dimensions for steel bodied valves are in accordance with ASA Standard B16.5-1953.

(This item supplements Black, Sivalls & Bryson, Inc., data on Pages 649-660 of the Composite Catalog, 21st Edition.)

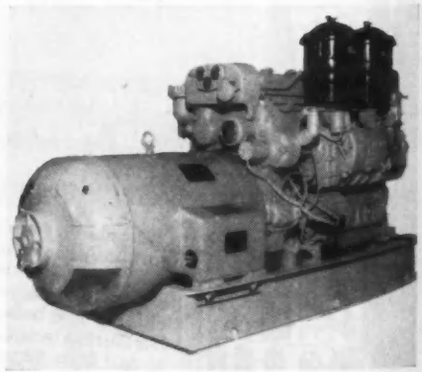
For more data, circle **No. E3** on Readers' Service Card, last page this issue.

## Manual Impact Wrench

The Swench is a manually operated impact wrench developed by the Swenson Engineering Company of Branford, Conn. It is the first hand-powered tool that incorporates the impact principle. It has the ability of delivering torque values up to 20 times that applied to the handle by the operator, allowing a single operator to manually tighten to practical tensions bolts up to 1¾ inches in diameter. As the impact force can be controlled through a simple spring setting, any desired bolt tension can be produced by the operator through control of the impact force and the number of impacts applied to the fastening.

The Swench has two drive extensions, one for loosening and one for tightening fastenings, and is operated like an ordinary ratchet wrench, using standard sockets to engage the nut or head of the fastenings. As the handle is pulled, a spring and rotar mechanism delivers rotary hammer blows or impacts automatically through the socket to the fastening, at torque values up to 20 times that applied to the tool handle by the operator. One impact or hammer blow is delivered for every 30 degree of movement of the handle. Impacts may be delivered in succession by continuous movement of the handle in one direction, or, by reciprocating the handle like a ratchet wrench, the operator can apply impacts singly or in short bursts. Each impact produces a clearly audible sound so that the number of impacts may be easily counted. This frees the operator of the necessity of having to read dials to reach predetermined stresses.

For more data, circle **No. E2** on Readers' Service Card, last page this issue.



## Delco Safe-T Generator

George Engine Co., Inc., has recently introduced the Delco Safe-T generator which is designed for use on hazardous locations to supply more nearly explosion-proof power. The increased safety of this generator is due to the fact that Delco

has eliminated all spark-producing parts—commutators, slip rings and brushes.

The conventional approach to the safety problem in power generators for drilling rigs has been to make these generators safer by relocating the generator excited and slip rings outside the machine proper and placing them in explosion proof housings. This has increased the size and price of the generators without producing the desired result. Delco's research and engineering know-how has produced the Delco Safe-T generator which eliminates the sparking or electric arcing components. In their stead is a new system of excitation which, when coupled with the proper regulation equipment, results in a machine with unusual flexibility and scope of application. In addition, the design of this machine practically eliminates the need for what has been known as normal maintenance and raises long life to a new peak, in addition to reducing radio interference to a minimum.

For more data, circle **No. E4** on Readers' Service Card, last page this issue.

## Asbestos Stem Packings

The Garlock Packing Company of Palmyra, N. Y., has announced two new styles of asbestos braid jacketed plastic core valve stem packings for high pressure and/or high temperature service. Designated Styles 5855 and 127, the new packings both utilize inconel wire in the packing jacket.

Style 5855 is for general service stem valve packing where conditions are not extreme, i.e., top stuffing box temperature range of 500° to 600° F., and pressures of several thousand pounds per square inch can well be handled providing the valve is designed to stay within the temperature limitations. Style 5855 has a jacket composed of commercial asbestos yarn reinforced with inconel wire and with a corrosion inhibitor.

Style 127 is for use in packing any fluid which will not affect the asbestos. It is ideally suited to extreme heat conditions, such as box temperatures of 750° F. and pressures to several thousand psi. It will withstand considerable super heat, and is an excellent high temperature oil refinery packing. Style 127 has a jacket composed of 90 percent asbestos yarn reinforced with inconel wire and with a corrosion inhibitor.

(This item supplements Garlock Packing Co. data on Page 1861 of the Composite Catalog, 21st Edition.)

For more data, circle **No. E5** on Readers' Service Card, last page this issue.

## Dual Switch and Gage

A new combination safety switch and pressure gage with both high and low pressure contacts on the one instrument is announced by Manufacturers', Inc. The unit can be used to shut down equipment or sound an alarm, flash lights or operate other types of controls on pipe line pumps, water flood projects, gas compressor stations or any place where either high or low pressures could cause damage to valuable unattended equipment.

Adjustable contacts are fully visible. They are available flush mounted on panels and factory-wired for simplified installation where multiple pressure applications are involved.

For more data, circle **No. E6** on Readers' Service Card, last page this issue.

## Forged Needle Valve

Hoke, Inc. of Englewood, N. J., has introduced a new series of small, forged brass needle valves, both angle and straight pattern, employing an O-ring stem seal. The series is especially designed for instrument air lines, test panels, pilot plant installations and graphic panel boards.

The O-ring stem seal does away with packing leaks and adjustments and can be helium leak tested for non-critical high vacuum service. Either vee point stem for accurate flow control or blunt point stem for full flow are available. Bodies will withstand 2000 pounds per square inch and integral bonnet construction is the simplest and strongest available design. In a choice of male or female pipe thread or Swagelok tube ends. Available for panel mounting.

For more data, circle **No. E7** on Readers' Service Card, last page this issue.

## Taper Face Flange

The recently introduced Tube-Turn 125-pound taper face lightweight welding neck flange offers important technical and cost advantages where the lighter schedule of pipe must be connected to 125-pound cast iron valves and other equipment. It is manufactured by Tube Turns, Louisville, Ky., a division of National Cylinder Gas Company.

The flange overcomes two difficulties. First, its tapered face causes greater pressure to be exerted near the bore. This eliminates the usual problems met in obtaining a leakproof seal when a conventional flange with a full face gasket is used. Second, strain gage tests have shown that the new flange, equipped with a full face gasket, can be safely bolted to cast iron or semi-steel flanges. That is, it will not overstress or crack them, nor the integrally cast valves, pumps and other facilities they may serve. Also, hydrostatic tests indicate that when the new flange is properly employed the joint is capable of withstanding approximately three times the pressure it could contain if the taper was omitted.

For more data, circle **No. E8** on Readers' Service Card, last page this issue.

## Corrosion Measurement

Instruments and techniques recently developed by Crest Instrument Company, Santa Fe Springs, Calif., measure the rate of progress of corrosion on an exposed element of a probe by measuring the changes in electrical resistance as the cross-section is reduced. Called the Corrosometer method, the technique involves a method of measuring corrosion by installing a special probe in the system under study, then following the progress of corrosion on the probe electrically by means of a special meter. Any member of probes may be used with a single meter, as a connection to a probe is necessary only at the time a reading is made.

The Corrosometer probe consists essentially of an exposed element which is part of an electrical circuit used to make resistance measurements on the element. The exposed element is made of whatever metal is of interest and can be used in three different forms: round wire, flat strip or thin-wall tubing. The Corrosometer instrument determines the extent of corrosion on the exposed element of a probe by measuring the changes in electrical resistance as the cross-section is reduced and gives readings directly in terms of micro-inches of corrosion.

For more data, circle **No. E9** on Readers' Service Card, last page this issue.

## 'Diamond'-Like Cutting Rod

Kutrite, a new sintered carbide composite rod, has been developed recently by B & W Metals Company of Houston. These crushed tungsten rods are used for building up fishing and cutting tools used in oil well drilling operations. Kutrite rods have been used to build up small coring heads and seismograph bits and the world's largest mill. The smaller cutting tool can be rebuilt with Kutrite at less than one-half their original cost, according to users. The giant mill was built up with Kutrite at one-half the cost of tool steel blades with six times more cutting ability.

Kutrite rods have a matrix tensile strength of 100,000 pounds per square inch and feature a guaranteed hardness of 91.08 to 93 Rockwell A. Anyone who can braze can easily apply Kutrite.

Kutrite rods are available in seven sizes, ranging from ⅜ inch-¼ inch to 30-45 mesh. The larger carbides are best for cutting, while the smaller ones are recommended for abrasive wear and adhering to outside and inside diameters.

(This item supplements B and W Incorporated data on Pages 377-384 of the Composite Catalog, 21st Edition.)

For more data, circle **No. E10** on Readers' Service Card, last page this issue.

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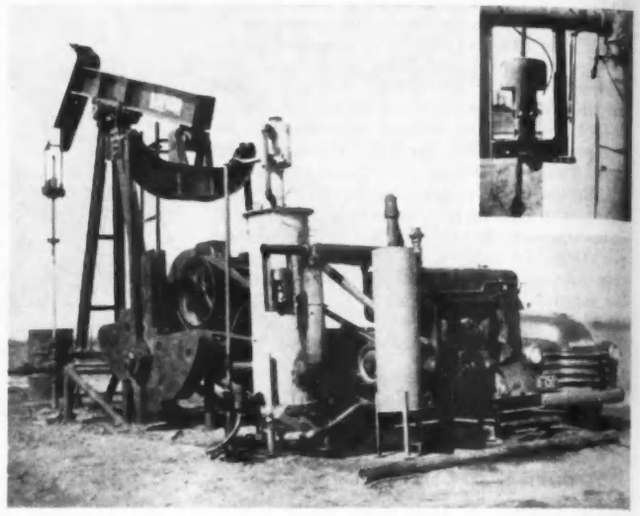
# PRODUCTION

## Temperature Control

By replacing electric temperature controls with a self-operating regulator, a maker of fuel generators has cut their operating costs and made them usable in the remotest oil field areas, independent of electric power. This was reported by the Powers Regulator Company, Skokie, Ill., manufacturer of automatic temperature controls.



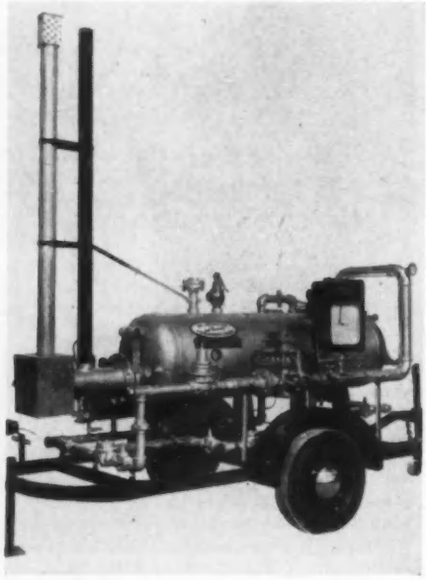
The generator heats a portion of the crude oil being pumped, then feeds the volatile gases produced into the internal combustion engine operating the pump. Hot exhaust gases from the engine are used to heat the crude oil in the generator. Butterfly valves in the exhaust line must be positioned to regulate the entry or by-pass of exhaust gases, thus keeping the generator temperature within the required 120-150° F. range.

A disadvantage was found in using an electric thermostat and damper motor to sense temperature changes and operate the valves. First was the requirement for electric power. In many cases, power lines are not available in remote oil field areas.

Another disadvantage is the positive all- or-nothing response characteristic of electrical regulators. The exhaust gases are either channeled entirely into the generator, or entirely around it, with no chance for gradual regulation.

Then Powers engineers suggested the use of their self-operating thermostatic motor. This motor consists of a thermal bulb, connecting capillary tubing, and a spring-opposed bellows which positions a thrust stem. The thrust stem is connected by spring-loaded linkages to the butterfly valves in the generator and exhaust lines. The thermal bulb, connected by a capillary to the regulator, is mounted within the generator, at the top.

For more data, circle **No. E11** on Readers' Service Card, last page this issue.



## Cold Weather Heating

Oil Metering and Processing Equipment Corp. of Houston has designed a special heating unit accessory for cold weather use on its well tester. The cold weather unit was first worked in the Rocky Mountain area. It is now available as optional equipment.

The heating unit has two purposes. One is to keep water, separated from oil in the well tester, from freezing. The second is to separate emulsified water from oil. The latter is accomplished by warming the oil until it allows the water to coalesce.

The well tester is a standard 24WT-0106 unit with a total liquid capacity of 1200 barrels per day. It has a working pressure of 125 pounds per square inch. The unit is a three-phase separator with positive displacement oil and water meters and a bellows-type (mercuryless) gas meter. It is equipped with a production time recorder which marks each barrel of oil discharged on a chart.

For more data, circle **No. E12** on Readers' Service Card, last page this issue.

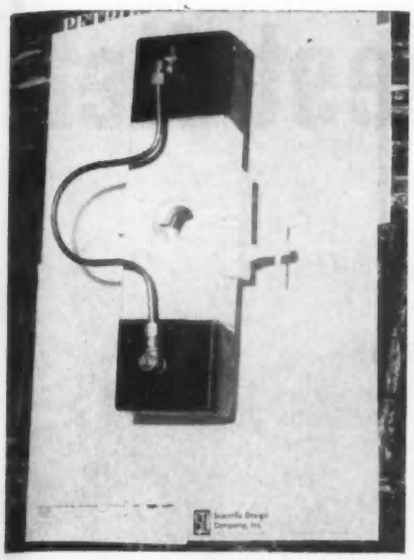
## Liquid Degreaser

A new liquid degreasing and emulsifying compound, named MM-17, solves the problem of safely cleaning oil storage tanks, particularly the sludge accumulation from heavy oils. MM-17 also effectively emulsifies oil spills on water and other equipment in oil fields, refineries, bulk terminals and on tankers.

The compound is safe to use, having no toxic fumes or burning effect on the hands. It has a flash point above 160° F., and carries U. S. Coast Guard Certification No. 281.

The compound is manufactured by The Daniel Company.

For more data, circle **No. E13** on Readers' Service Card, last page this issue.



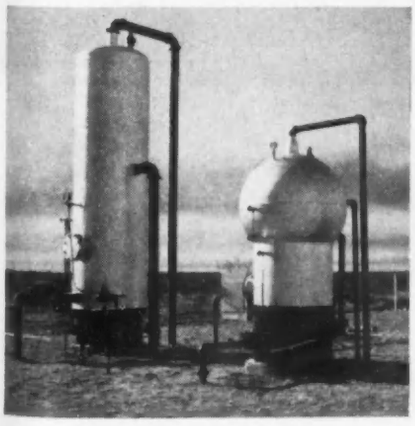
## Dual Purpose Equipment

The stuffing box packing saver and fluid injector, manufactured by Julius A. Blum of Houston, serves a dual purpose in connection with pumping wells. It is designed so that the spring loaded polish rod brighteners rid the polish rod of corrosion deposits and thereby prevent these deposits from building up and cutting out the packing in the stuffing box. The polish rod brighteners are made of bronze and are available in sizes to fit all popular polish rod diameters.

There are reservoir compartments that can be used to store fluids that counteract corrosion that can be ejected in a film on the rod to reduce corrosion build-up and its attack on the polish rod. The other purpose of this equipment is that the fluid storage compartment can be used for the storing and the injection of paraffin solvents in the casing and flow lines. There are two compartments; one can be used for one type of fluid and the other for another.

This equipment is made to attach to almost any kind of stuffing box. It does not require a special installation other than a wrap-around method latching around the polish rod and tightening holding bolts in place to the stuffing box.

For more data, circle **No. E14** on Readers' Service Card, last page this issue.



## Metering Separator

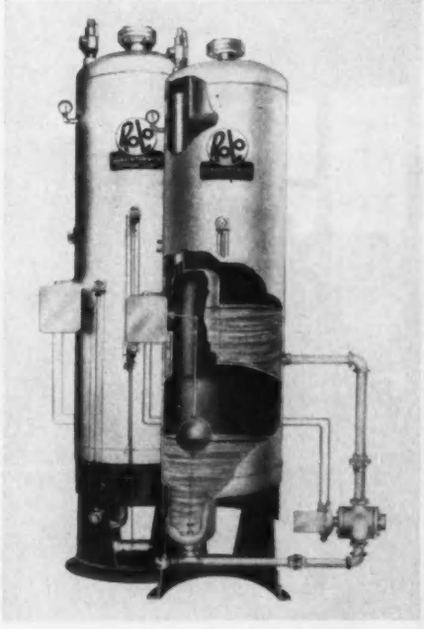
Sivalls Tanks, Inc., Odessa, Texas, recently introduced a spherical metering separator for well test and other purposes. It consists of a 41-inch outside diameter spherical oil and gas separator and a dump type positive displacement meter, with a new controls system designed to obtain high accuracy.

This metering separator offers a number of distinct advantages, including compactness—over-all height only 78 inches—and high capacity. It is rated at 6,000,000 cubic feet of gas and 1500 barrels of well fluids per day.

The new controls system has shown an accuracy in excess of 99 percent in actual field tests. Accuracy is obtained by use of a snapper type diaphragm-operated pilot to cause rapid action of the motor valves, and an action delay mechanism to prevent both inlet and outlet motor valves to the meter compartment from being open at the same time, thus preventing flow-through of unmetered oil.

The controls system is very simple and easily calibrated, yet rugged and dependable. The separator employs the Sivalls patented centrifugal separating ring and ceramic saddle mist extractor to effect efficient separation of gas from the well fluids.

For more data, circle **No. E15** on Readers' Service Card, last page this issue.



## Oil Meter and Separator

An oil meter and separator in one integral unit at only slightly greater cost than a separator alone is being offered by Rolo Manufacturing Company.

The Rolocheck metering separator features the new neutral position 3-way meter valve. This valve has a dead-center position, which permits only one of the two inner ports to open at any given time. With 2-way valves and with other types of 3-way valves, there are instantaneous periods during the valve switching operation when both valves could be open at the same time, allowing slippage around the meter, causing inaccuracies. This cannot happen with the neutral position 3-way valve.

(This item supplements Rolo Manufacturing Co. data on pages 4398-4399 of the Composite Catalog, 21st Edition.)

For more data, circle **No. E16** on Readers' Service Card, last page this issue.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KINLEY TUBING PERFORATOR

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CATALOG NUMBER 569-AA5

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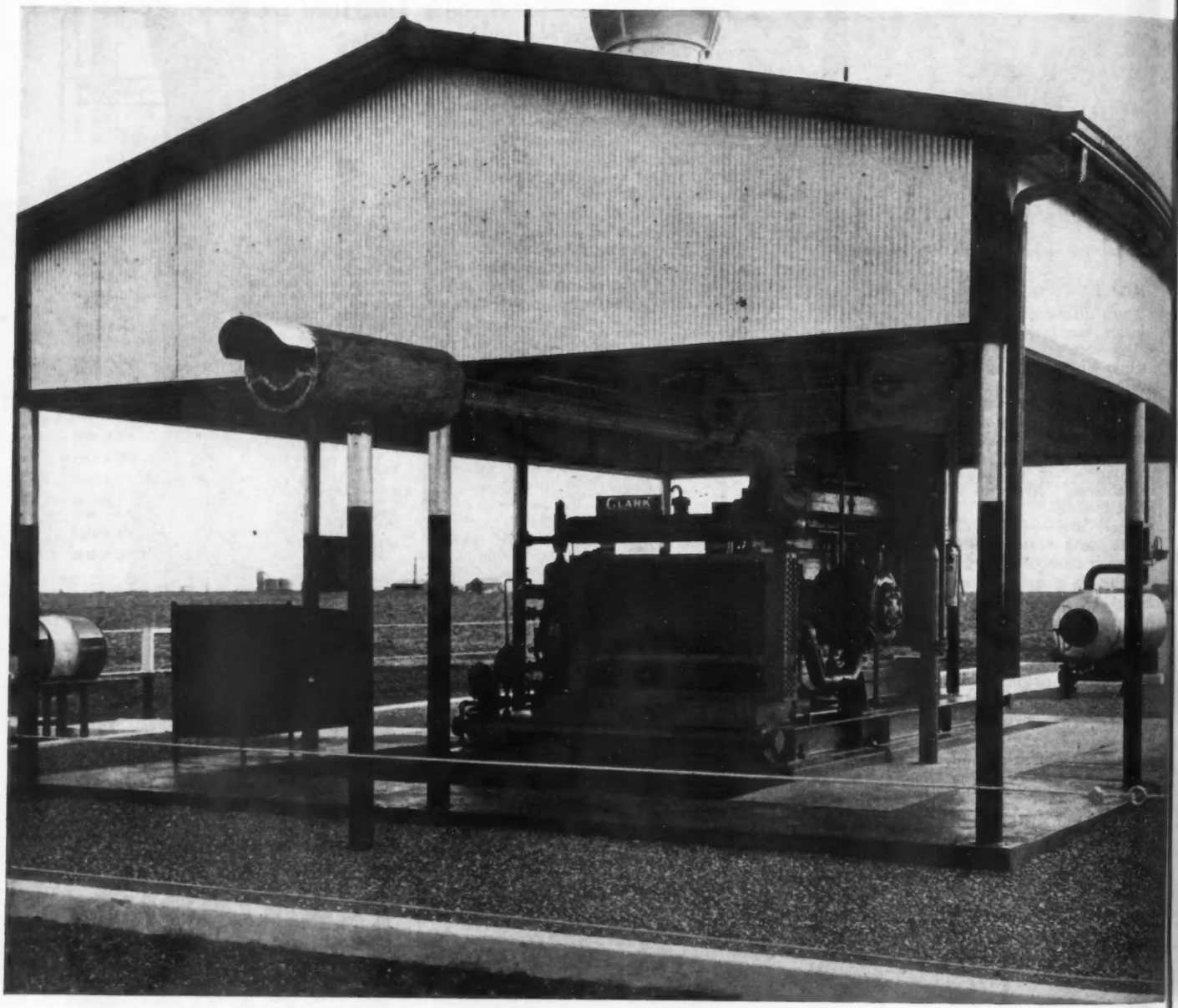

# d compressor on the market."

## That's how Mr. John Walker of P. R. Rutherford feels about his Clark CFA packaged field compressor.

After three months of operation, P. R. Rutherford is so pleased with their first Clark CFA that they have ordered a second unit. Rutherford is using the CFA near Woodsboro, Texas, on gas lift service taking gas at 20-30 psig. and compressing it to 700 psig.

The CFA is a true thoroughbred with all components being designed for rugged field service. The compressor uses the balanced/opposed principle, made famous by Clark, to assure vibrationless operation. In the field, this means the CFA doesn't have to be tied down to a massive foundation. Just enough to level it is all that's required. The balanced/opposed design also permits high speed operation because there are no unbalanced forces. Operating at 1000 rpm., this five inch stroke compressor is *directly* coupled to a standard, proved design, oil field engine operating at the same speed. Drive belts and gears which can be a headache in remote locations, are not required. The engine and compressor together with a radiator for oil, water and gas cooling, is mounted on a rigid skid. The assembled unit is a compact, completely self-contained compressor station.

For tough field use there is only one modern, direct-connected unit available specifically designed for this service . . . the Clark CFA.

Two and four cylinder models are now available covering a horsepower range of 100-350 bhp.

The units are assembled, run-in and tested at the factory. They are ready to go when you receive them. Clark CFA specialists will give you all the facts.

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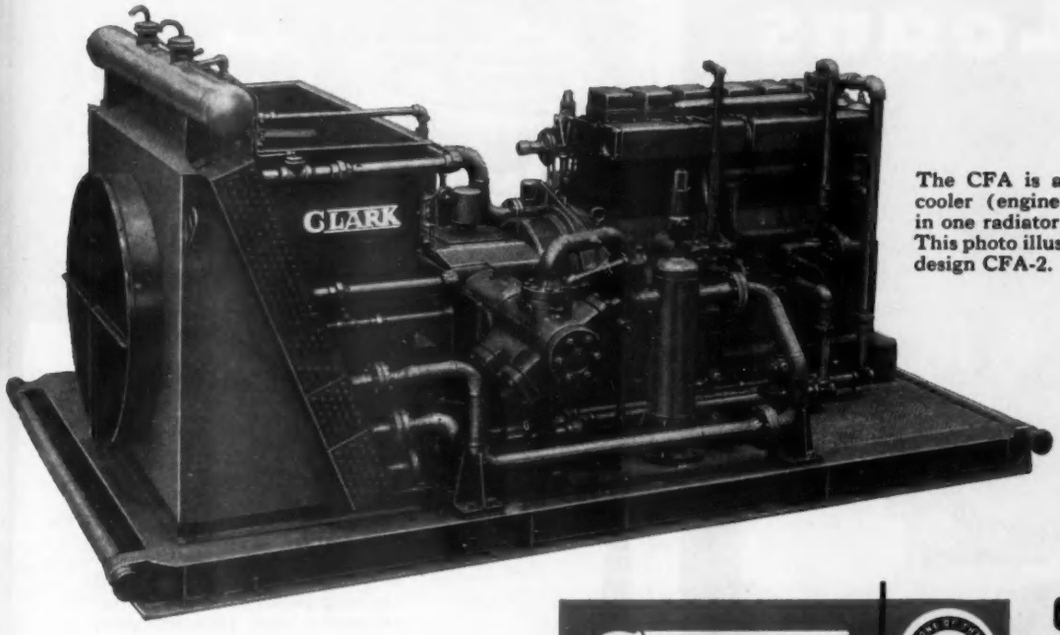



The CFA is available with a unitized cooler (engine and compressor cooling in one radiator) or individual radiators. This photo illustrates a 141 bhp. unitized design CFA-2.

CLARK®

**CFA packaged field compressors**

## Rod and Tube Derrick

A new 85-foot servicing derrick, designed especially to afford added height for rod and tube servicing without sacrificing portability, has been announced by Bucyrus-Erie Co., South Milwaukee, Wis. The two-section, power-lowered telescoping derrick lays down over the spudder for fast road travel and is available as special equipment for use with the firm's largest model oil well spudder—the 48-L.

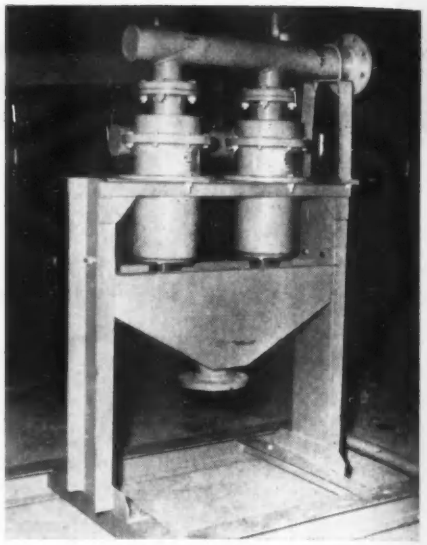
Power-raised, the derrick has a built-in four-part tackle and oversize derrick hoist drum. In raising the derrick, 12 guy lines are set—four each from the lower section, the fingerboard, and the top of the derrick respectively.

A fingerboard is arranged to hold a total of 7920 feet of well tubing in 60-foot stands. The derrick can handle up to 60,000 pounds of tubing.

The new servicing derrick features a sturdy structural design similar to the standard 60-foot 48-L derrick. The lower section consists of 12-inch channels and the upper section is made of laced angles to form 11-inch channels. Reinforcing is added at the hinge pin, and a casing tackle strut is provided.

(This item supplements Bucyrus-Erie Co. data on Pages 889-894 of the Composite Catalog, 21st Edition.)

For more data, circle **No. E17** on Readers' Service Card, last page this issue.



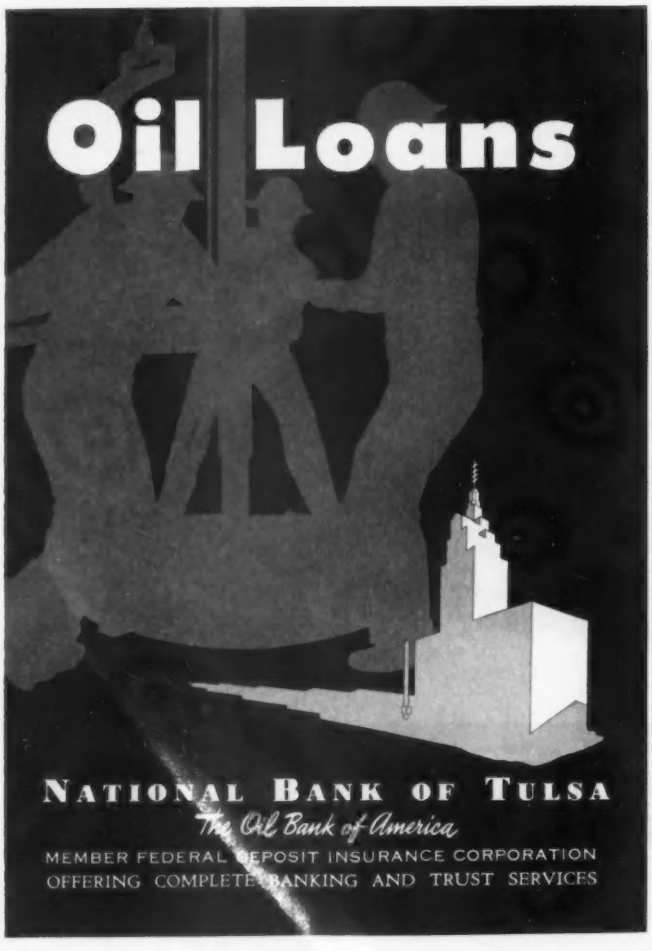
## Hard Formation D-Sander

A new Size 2 Dorrco D-Sander, designed especially for hard formation drilling, features low first cost and operating cost, light weight and portability. Manufactured by Dorr-Oliver and sold by Salt Water Control, Inc., the D-Sander also can be used for slip hole drilling in a wide variety of formations.

The Size 2 D-Sander has a capacity of up to 250 gallons a minute. It compliments the capacity ranges of the Size 4 and Size 6 which have capacities up to 500 and 800 gallons a minute, respectively. The new D-Sander thus enables Salt Water Control to furnish the proper size for any drilling rig or any drilling area of the country.

Drilling fluids are substantially freed of drilled solids. Particularly in the Gulf Coast area, but in other sectors, too, the D-Sander conquers the problem thrown up by abrasive sand. The life of bits and pump parts are substantially increased. In addition, the high viscosity of mud laden with drilled solids reduces drilling rates as much as 25 percent. In those sections of the hole where unweighted mud can be used, important savings in drilling costs are realized.

For more data, circle **No. E18** on Readers' Service Card, last page this issue.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# New Equipment Catalogs and Literature

**For more data on New Equipment or copies of Catalogs and Literature reviewed in this issue, use the Reader's Service postcards just inside the back cover and facing the Advertisers Index. Simply circle code numbers of items desired—sign and mail card. Requests are transmitted to the manufacturer as soon as received by us for mailing of desired information directly to you.**

## Plug Valve Catalog

New 28-page catalog shows 100 percent pipe area, venturi, round port, and diamond port Homestead lubricated plug valves in a variety of metals for 150 pounds steam working pressure, 200 pounds oil-water-gas, and A.S.A. 150 and 300 pound classes. Complete with engineering dimensions, this catalog, Section 5 of Reference Book 39, also shows different types of power operators for valves, in addition to complete lines of lever operated, and worm and gear operated valves.

To get a copy, circle **No. E19** on Readers' Service Card, last page this issue.

## Dowell Products Folder

A new Dowell Incorporated folder describes eight new developments in products, equipment and services of Dowell Research to assist in getting faster payout through increased oil and gas production. They are Sandlock, Riverfrac, Dexet, Cealment, Freflo, Stabilized Acid, F. L. A. and Remote-controlled Allison-powered pumpers.

To get a copy, circle **No. E20** on Readers' Service Card, last page this issue.

## Flexible Coupling Booklet

The Morse, 16-page, flexible chain coupling catalog has been completely revised. Specifications, dimensions, ratings and application are given on series DSC, series SA silent chain coupling and series DRC roller chain couplings. Pertinent information is also tabulated on stamped steel covers, plastic covers and split aluminum covers.

Included in the new catalog is general information explaining the purpose and function of flexible chain couplings.

To get a copy, circle **No. E21** on Readers' Service Card, last page this issue.

## Wire Rope Sling Booklet

"Roebling Wire Rope Slings and Assemblies," just off the press is available to readers. John A. Roebling's Sons Corporation has issued the brochure. It is a new concept of sling cataloging and was designed for quick and accurate sling selection and ordering. It was organized around a simplified coding system that will be helpful to those concerned with material-handling problems.

To get a copy, circle **No. E22** on Readers' Service Card, last page this issue.

## Drillable Packer Folder

The Guiberson Corporation, Dallas, Texas, one of the Dresser Industries, announces publication of a two color, four page bulletin on the Guiberson permanent completion Type A drillable packer. The packer is recommended for single or multiple zone production, for acidizing, flooding, pressure operations and numerous other applications. The bulletin gives illustrations and descriptions of the packer and accessories.

Also included are detailed outlines of running and setting procedures along with surface setting stroke tables for both 2 inch and 2½ inch tubing.

To get a copy, circle **No. E23** on Readers' Service Card, last page this issue.

## Cold-Frac Catalog

Black, Sivalls & Bryson, Inc., announces the publication of Catalog 33-01 on its low temperature separation unit, the Model MDH Cold-Frac system, for extremely high pressure wells, wells producing wax and/or salt water and wells with a pressure life of three to five years.

The new unit includes four important design improvements: An improved liquid knockout that gives greater scrubbing efficiency and eliminates wax and salt water problems; a new heat exchanger designed specifically for the new unit which achieves maximum cooling with minimum pressure drop through counterflow with cold sales gas; an improved separator design that effects maximum separation of liquids, hydrates and gas; and skid-mounting of all units in a compact assembly that permits shipment of the completely-assembled unit. Field hookup requires only four connections.

To get a copy, circle **No. E24** on Readers' Service Card, last page this issue.

## Gas Engine Brochure

An improved line of Model G-825 Superior gas engines, engineered especially for oil field application, has been developed by the White Diesel Engine division of the White Motor Company, Springfield, Ohio.

Bulletin 104 explains features of the four cycle, six and eight cylinder engines, designed to operate at 900 rpm and from 200 to 630 bhp continuous.

Many parts of the G-825 are interchangeable with White's Superior PTD oil field engine. The unit also fits the PTD engine skids, thus permitting quick and easy engine interchange in the field.

To get a copy, circle **No. E25** on Readers' Service Card, last page this issue.

## Hydraulic Pump Bulletin

A bulletin describing the complete line of Hydrax surface hydraulic pumping units has been recently issued by Axelson Manufacturing Company, Division of U. S. Industries, Inc., Los Angeles. Included is a brief description and specifications for all Hydrax units—the 4-foot Jr., 6 and 10-foot units, 10-foot Counterbalance, Long-Stroke (26½-foot Counterbalance), Dual unit (which pumps two wells hydraulically from a single oil and power source) and the Double Ram (for pumping low gravity crude oil).

To get a copy, circle **No. E26** on Readers' Service Card, last page this issue.

## Traveling Block Bulletin

National Supply traveling blocks of five capacities which cover all oil field drilling requirements ranging from 90 to 450 tons are described in Bulletin No. 471, released by The National Supply Company, Pittsburgh. Features of design and construction are presented in addition to specifications and dimensions.

To get a copy, circle **No. E27** on Readers' Service Card, last page this issue.

## Triplex Pump Bulletin

The National F-15 triplex pump is presented in 4-page Bulletin No. 466 by National Supply Company, Pittsburgh. This 2-in. stroke pump is the smallest of four of this type ranging up to 5-in. stroke. Applications include waterflooding, salt water disposal and other oil field services.

Rating ranges from 6 to 15 horsepower output with discharge pressures of 500 to 2520 lb. per sq. in. Capacities range from 4.1 to 51.7 gpm., depending on plunger size and speed of operation. Performance curves and specifications are given.

To get a copy, circle **No. E28** on Readers' Service Card, last page this issue.

## Valve Lubricant Booklet

A completely new 12-page version of Rockwell Manufacturing Company's comprehensive bulletin on "Lubricants for Rockwell-Nordstrom Valves" (V-220, Rev. 1) provides more detailed lubricant selection data, including information about 80 new lubricants.

Four new lubricants not listed in previous bulletins are described in detail. The four include:

No. 555, a general-purpose lubricant for hydrocarbon liquid and gas services.

No. 921 for strong acids and alkalies, alcohols, glycerine and glycols, amines, aqueous solutions, hot water and hot asphalt.

No. 860 for natural gas transmission line services.

No. 833 for aviation gasoline, jet fuel, hydrocarbon and aromatic solvent services.

To get a copy, circle **No. E29** on Readers' Service Card, last page this issue.

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